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ASTOR, LENOX AND
TILDEN FOUNDATIONS.

THOMAS DILWORTH,
SCHOOLMASTER.

H.M.HUNT.
1811

THE

SCHOOLMASTER'S ASSISTANT,

BEING A

COMPENDIUM OF ARITHMETIC,

BOTH

PRACTICAL AND THEORETICAL.

IN FIVE PARTS.

CONTAINING,

I. Arithmetic in whole Numbers, wherein all the common Rules, having each of them a sufficient Number of Questions, with their answers, are methodically and briefly handled.

II. Vulgar Fractions, wherein several Things, not commonly met with, are distinctly treated of, and laid down in the most plain and easy manner.

III. Decimals, in which, among other things, are considered the Extraction of Roots; Interest both simple and compound; Annuities, Rebate, and Equation of Payments.

IV. A large collection of Questions with their Answers, serving to exercise the foregoing Rules, together with a few others both pleasant and diverting.

V. Duodecimals, commonly called Cross Multiplication; wherein that sort of Arithmetic is thoroughly considered, and rendered very plain and easy, together with the Method of proving all the foregoing Operations at once, by Division of several Denominations, without Reducing them into the lowest Terms mentioned.

The Whole being delivered in the most familiar way of Question and Answer, is recommended by several eminent Mathematicians, Accomptants, and Schoolmasters, as necessary to be used in Schools by all Teachers, who would have their Scholars thoroughly understand, and make a quick progress in Arithmetic.

To which is prefixt,

AN ESSAY

ON THE EDUCATION OF YOUTH;

Humbly offered to the consideration of

PARENTS.

BY THOMAS DILWORTH,

AUTHOR OF THE NEW GUIDE TO THE ENGLISH TONGUE; YOUNG BOOK-KEEPER'S ASSISTANT, &c.

NEW-YORK:

PUBLISHED BY E. DUYCKINCK AND R. M'DERMUT,

1810.

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GEORGE LONG, Printer.

THE

PREFACE DEDICATORY

To the Reverend and Worthy

SCHOOLMASTERS

IN GREAT BRITAIN AND IRELAND.

GENTLEMEN,

AFTER returning you my most hearty thanks for your kind acceptance of my New Guide to the English Tongue, permit me to lay before you the following pages which are intended as an help towards a more speedy improvement of your Scholars in Numbers, and at the same time, to take off that heavy burden of writing out of rules and questions, which you have so long laboured under.

I need not, I presume, say any thing concerning the usefulness of, and advantages that accrue to mankind in general, from Arithmetic, since they are, by this time, pretty well known, and also deserve the employment of a much better pen than mine can pretend to be; but I will venture to say thus much, and I believe you will pardon me for it, that this (by putting one into each arithmetician's hand) will not only prove a kind assistant to you, but upon trial, be found at once, both to delight and improve the minds of those who are committed to your care.

I have gone through all the parts of arithmetic, commonly taught in schools, and have included several others no less useful: and though I have given more questions to work upon in each rule, (which was absolutely necessary; none having yet calculated their performances of this kind, for the use of school-boys) I have endeavored at the same time to reduce the whole, to as neat and portable a volume as any that have gone before me.

I must confess, I do not propose by this, to add to any master's knowledge in arithmetic, who, I imagine, is already acquainted with every thing contained in this compendium; for which reason it is reduced to the narrow compass it now appears in, without particular directions for the working the operations at large; and therefore I conceive here is room enough left for every man to speak his own mind, and instruct his pupils in his own method. And I believe, it is confessed

by all, that it is a task too hard for children to be made complete masters of arithmetic; and therefore the best way of instructing them in it is most certainly, first to give them a general notion of it, in the easiest manner, and next to enlarge upon it afterwards if there be time; otherwise it must be done by themselves, as their increase of years and growth in understanding will permit. *" For arithmetic is the more valuable, as it is the more exact, easy, and short; and the art lies in giving as few rules as possible, and clearly explaining them, and not confounding principles together, and then diversifying them into several rules, when they are built upon the same reason, which has not only made arithmetic seem difficult of access, but has hindered many from being accomptants."

To enter into a detail of the following particulars, would be tedious, and swell this preface beyond its just limits; but that the kind reader may not be wholly at a loss, I shall beg leave to speak as follows, viz.

1. That the whole is divided into five parts, as the title page expresses it.

2. That the rules and examples are contrived in the plainest manner, and the whole put in such an easy method as is no where else extant.

3. I have omitted reduction of foreign coins, partly because, all those tables which I have met with, which shew the value of foreign coins in English money, are very erroneous, but principally because all such questions as relate to the turning of the money of one country into that of another, are much better answered under the head of exchange. For the value of foreign species, (such I mean as relate only to exchange) both of gold and silver, in every country is unsettled, and therefore such coins are subject to vary in their prices, as the merchants find an opportunity to profit by them. Hence proceed the various courses of exchange; and from them again, the particular worth of any quantity of foreign coin in English money, which is sometimes more, sometimes less, according as the course of exchange runs at that time, when such foreign coins become due. Add to this the agio or advance money, usually paid abroad on the changing current money into exchange or bank money, which is two, three, or more per cent. in payment, according to what the exchange or bank money is worth more than the current money, and this cannot be done otherwise than by the rule of three.

4. In interest, &c. by decimals, I have followed Mr. Ward's method, by which means the rule is drawn into a much narrower compass; and appears more beautiful to the eye, than in words at length.

*Watts' Essay.

5. In all places where it could be done conveniently, I have given directions for varying the examples by way of proof; because it not only discovers the reason of the operation, but at the same time both produces a new question, and proves the old one. And sure I am, that the varying the question, when it may be done under the same rule, contributes very much towards a thorough understanding of it, and making a good accomptant, as every one's experience will teach him.

6. I have thrown the subject of the following pages into a catechetical form, that they may be the more instructive; for children can better judge of the force of an answer, than follow reason through a chain of consequences. Hence also it proves a very good examining book; for at any time, in what place soever the scholar appears to be defective, he can immediately be put back to that place again, without the formal way of beginning every thing anew.

7. In order to make the progress still quicker, every example, to be wrought, hath its answer annexed to it: so that they who do not chuse to have every operation proved by varying the question, may know without it whether the work be right or not.

8. Concerning contractions in numbers, which some are very fond of, I have said very little, and my reason is this; contractions are no further valuable than they are useful; hence, if in order to lessen the number of figures in an operation, there is not only more time spent than in the ordinary way, but those contractions are also more liable to error, such contractions ought to be rejected.

And now, after all, it is possible that some who like best to tread the old beaten path, and to sweat at their business when they may do it with pleasure, may start an objection against the use of this well intended assistant; because the course of arithmetic is always the same; and therefore say, 'that some boys, lazily inclined, when they see another at work upon the same question, will be apt to make his operation pass for their own:' but these little forgeries are soon detected by the diligence of the tutor: Therefore, as different questions to different boys, do not in the least promote their improvement: so neither do the same questions hinder it. Neither is it in the power of any master, (in the course of his business) how full of spirits soever he be, to frame new questions at pleasure in any rule, but the same questions will frequently occur in the same rule, notwithstanding his greatest care and skill to the contrary.

It may also be further objected, 'that to teach by a printed book, is an argument of ignorance and incapacity,' which is no less trifling than the former. He indeed, (if any such there be) who is afraid his scholars will improve too fast, will undoubtedly decry this method. But that master's ignorance can never be brought in question, who can begin

and end it readily; and most certainly, that scholar's non-improvement can be as little questioned, who makes a much greater progress by this, than he possibly can by the common method.

As to the order of the rules, I can hardly find two masters follow it alike; some liking best to teach that rule first, which another thinks more convenient to teach afterward; while a third looks upon it as a matter quite indifferent among some rules, which he teaches first. But this need be no hindrance to the use of this book. For however the rules are placed here, every man may turn to that rule first, which he likes should be taught first; and if a master has a mind to teach vulgar fractions immediately after reduction of whole numbers, as some do, he may do it as easily as in the order they now lie.

To the eleventh edition, and which is continued in this, I have added duodecimals, commonly called cross multiplication; wherein I have largely treated of that sort of arithmetic, in every branch; shewing how the same may be proved by varying the operations; by whole numbers, by vulgar fractions and by decimals; and lastly by a particular sort of division, wherein the divisor, dividend and quotient are each of them, of several denominations, just as the factors and products are in multiplication, without reducing them into the lowest term or denomination mentioned. And as duodecimals, by all the writers that I have seen, except Mr. Hawney, have only been superficially treated of, I think, I may venture to say, without any breach of modesty, that this is the completest piece of that kind extant.

As a further improvement of this compendium, I have considerably enlarged the rule of exchange, and among others, have given a variety of examples of real bills of exchange, to be wrought by the pupil in order to shew him, in a more particular manner, the necessity of knowing how to turn the money of one country into the money of another country, value for value, where the merchant happens to be engaged in foreign trade. I have also taken the liberty to put the double rule of three after exchange, which in most of the former editions stood before it, to the end that all the mercantile rules in whole numbers might stand together; and likewise that the pupil might, at the end of exchange, enter upon a course of book-keeping, if there should not be time for him to go through the whole compendium first.

I should have been very glad to have seen an attempt of this nature, stampt by the authority of some person of distinction and of better abilities; but since no abler hand has undertaken it, I hope its homely appearance will not lessen its usefulness.

The printer's errors as well as my own defects, I hope will candidly be overlooked: but because a man's failings are so familiar to himself, that he can scarce discern them; therefore the kind admonitions of a good natured reader, shall always be very acceptable.

I have nothing more to add, but my repeated thanks for favours received, together with my earnest desire that you may be prosperous in your several undertakings, and to beg this additional favour of being esteemed,

Gentlemen,

Your most humble, and

Most obedient Servant,

THOMAS DILWORTH.

ON THE

EDUCATION OF YOUTH.

AN

ESSAY,

HUMBLY OFFERED TO THE CONSIDERATION OF PARENTS.

THE right education of children, is a thing of the highest importance, both to themselves, and the commonwealth. It is this, which is the natural means of preserving religion and virtue in the world; and the earlier good instructions are given, the more lasting will be their impression. For it is as unnatural to deny these to children, as it would be to withhold from them their necessary subsistence. And happy are those, who, by a religious education and watchful care of their parents, their wise precepts and good examples, have contracted such a love of virtue and hatred of vice as to be removed out of the way of temptations. And 'tis owing to the want of this education, that many when they leave their schools, do not prove so well qualified as might be expected. This great omission being, for the most part, chargeable on the parents, I hope the following particulars, (which are the common voice of our profession,) will not be taken amiss. And

1. A constant attendance at school, is one main axis whereon the great wheel of education turns. Therefore, if that observation which is commonly made by parents, be true, that the masters have holy days enough of their own making, there is, by their own confession, no necessity for them to make an addition.

2. Parents should never let their own commands, run counter to their master's, but whatever task he imposes on his pupils, to be done at home, they should be careful to have it performed in the best manner, in order to keep them out of idleness. * "For vacant hours move on heavily and drag rust and filth along with them, and 'tis full employment, and a close application to business, that is the only barrier to keep out the enemy and save the future man."

* Watts' Essay.

3. Parents themselves should endeavour to be sensible of their children's defects, and want of parts; and not blame the master for neglect, when his greatest skill, with some, will produce but a small share of improvement. But the great misfortune is, as the proverb expresses it, every bird thinks her own young the fairest; and the tender mother, though her son be of an ungovernable temper, will not scruple to say, he is a meek child, and will do more with a word than a blow, when neither words nor blows are available. On the other hand some children are of a very dull and heavy disposition; and are a long time in gathering but a little learning, and yet their parents think them as capable of instruction, as those who have the most bright and promising parts; and when it happens that they improve but slowly, tho' it be in proportion to their own abilities, they are hurried about from school to school, till at last they lose that share of learning, which otherwise, by staying at the same school, they might have been masters of. Just like a sick, but impatient man, who employs a physician to cure him of his malady, and then, because the distemper requires time, as well as skill to procure his health, tells him, "he has all along taken a wrong method;" turns him off, and then applies to another whom he serves in the same manner: and so proceeds till the distemper proves incurable.

4. It is highly necessary that children should be early made sensible of the scandal of telling a lie: to this end, parents must inculcate upon them betimes, that most necessary virtue of speaking truth, as one of the best and strongest bands of human society and commerce, and the foundation of all moral honesty.

5. Injustice (I mean the tricking each other in trifles, which so frequently happens among children, and is very often countenanced by the parents, and looked on as the sign of a very promising genius) ought to be discouraged betimes, lest it should betray them into that vile sin of pilfering and purloining in their riper years; to which the grand enemy of mankind is not wanting to prompt them by his suggestions whenever he finds their inclinations have a tendency that way.

6. Immoderate anger, and a desire of revenge, must never be suffered to take root in children. For (as a most reverend divine observes) † "If any of these be cherished or even let alone in them, they will, in a short time, grow headstrong and unruly; and when they come to be men, will corrupt the judgment, turn good nature into humour, and understanding into prejudice and wilfulness."

7. Children are very apt to say at home what they see and here at school, and oftentimes more than is true; and some parents, as often, are weak enough to believe it. Hence

† J. B. Tillotson.

arise those great uneasinesses between the parents and the master, which sometimes are carried so high, as for the parent, in the presence of the child, to reproach him with hard names, and perhaps with more abuseful language. On the contrary,

8. If parents would have their children improve in their learning, they must cause them to submit to the little (imaginary) hardships of the school, and support them under them by suitable encouragements. They should not fall out with the master upon every idle tale, nor even give their children the liberty of expressing themselves that way; but they should, by all means, inform them frequently, 'That they ought to be good boys, and learn their books, and always do as their master bids them, and that if they do not, they must undergo the pain of correction.' And it is very observable what a harmony there is between the master and the scholar, when the latter is taught to love and have a good opinion of the former; and then, with what ease does the scholar learn! With what pleasure does the master communicate!

9. The last thing that I shall take notice of, is, that while the master endeavors to keep peace, good harmony, and friendship among his scholars, they are generally taught the reverse at home. * "It is indeed but too common for children to encourage one another and be encouraged by their friends in that savage and brutish way of contention, and to count it a hopeful sign of mettle in them to give the last blow, if not the first, whenever they are provoked: forgetting at the same time, that to teach children betimes to love and be good natured to others, is to lay the true foundation of an honest man. Add to this, that cruel delight which some are seen to take in tormenting and worrying such poor animals and insects as have the misfortune to fall into their hands. But children should not only be restrained from such barbarous diversion, but should be bred up from the beginning to an abhorrence of them," and at the same time be taught that great rule of humanity, to do to others as we would they should do to us.

From what has been said relating to the management of children at home, the necessity of the parents joining hands with the schoolmaster appears very evidently. For when the master commands his pupils to employ their leisure time in getting some necessary parts of learning, their friends should not command them to forbear: and when they ought to be at school at the stated hours, they should not be sent an hour or two after, in the time of health, sometimes with a lie in their lips to excuse their tardiness, and sometimes with an order, and a brazen front, to tell their master, their friends think it time enough to come to school at nine in the morning, because the weather is a little cold, or because they

* Talbot's Christian Schoolmaster.

must have their breakfast first. I say parents should not act so indiscreetly, because it clips the wings of the master's authority. It makes boys first despise and undervalue their teachers, and then become unmannerly and impertinent to them, correction for which, makes the tutor hated by the children, and then there naturally follows either a total disregard to business, or a general carelessness in every thing they do. And

While I am speaking of the education of children I hope I shall be forgiven if I drop a word or two relating to the fair sex—It is a general remark that they are so unhappy as seldom to be found either to spell, write, or cypher well: and the reason is very obvious, because they do not stay at their writing schools long enough. A year's education in writing is, by many, thought enough for girls, and by others it is thought time enough to put them to it, when they are eighteen or twenty years of age, whereas by sad experience, both these are found to be the one too short a time, and the other too late. The first is a time too short, because, when they are taken from the writing school they generally forget what they learnt, for want of practice: and the other too late because then they are apt to look too forward, imagine all things will come of themselves without any trouble, and think they can learn a great deal in a little time; and when they find they cannot compass their ends as soon as they would, then a very little difficulty discourages them: and hence it is that adult persons seldom improve in the first principles of learning as fast as younger ones. For a proof of this, I appeal to every woman, whether I am just in my sentiments or not. The woman who has had a liberal education this way, knows the advantages that arise from a ready use of the pen; and the woman who has learnt little or nothing of it, cannot but lament the want of it. Girls therefore ought to be put to the writing school as early as boys, and continued in it as long, and then it may reasonably be expected that both sexes should be alike ready with their pen. But for want of this, how often do we see women, when left to shift for themselves in the melancholy state of widowhood, (and what woman knows that she shall not be left in the like situation?) obliged to leave their business to the management of others, sometimes to their great loss, and sometimes to their utter ruin; when, on the contrary, had they been ready at their pen, could spell well, and understand figures, they might not only have saved themselves from ruin, but perhaps have been mistresses of good fortunes. Hence then may be drawn the following, but most natural conclusion, viz. † "The education of youth is of such vast importance and of such singular use in the scene of life, that it visibly carries its re-

† Watts' Essay,

commendation along with it: For on it, in a great measure depends all that we hope to be: every perfection that a generous and well disposed mind would gladly arrive at: 'Tis this that stamps the distinction of mankind, and renders one man preferable to another: Is almost the very capacity of doing well; and remarkably adorns every point of life." And as the great end of human learning is to teach a man to know himself, and thereby fit him for the kingdom of heaven: So he that knows most, consequently is enabled to practise the best, and become an example to those, who know but little, or are quite ignorant of their duty. I am,

Your and your children's well wisher,

THOMAS DILWORTH.

TO

MR. THOMAS DILWORTH,

ON HIS

COMPENDIUM OF ARITHMETIC,

INTITLED THE

SCHOOLMASTER'S ASSISTANT.

WHILE some, seducive of the rising age,
Expose for hire, the lewd and factious page,
On every stall appear the public pest,
Deep bane instilling in the tender breast;
Thou, friend of moral as of social truth!
Employ'st thy toils to mend our growing youth.
Thy cares, how worthy of the good and wise,
Impow'r the embryo genius first to rise?
Make the dark clues of science plain to find,
And through its mazes lead the pleasur'd mind.
E'en now afresh, unweary'd in thy pains,
For future times thy recent task remains:
By double motives it assures to please,
The youth's instructor, and the tutor's ease:
From darker forms it clears encumber'd rules,
And learning makes the fit delight of schools.
Thy labors, friend, have found their just success,
And gen'ral plaudits thy desert confess;
O may THIS WORK, nor THIS be found thy last,
Nor sordid pride o'erlook, nor envy blast.
Far as our mother-tongue extends, be known,
And grateful pupils thy assistance own.

MOSES BROWN.

TO

MR. THOMAS DILWORTH,

ON HIS

SCHOOLMASTER'S ASSISTANT.

DILWORTH, the man by gracious heaven design'd
A friend, a father, to the human kind:
Whose active diligence, and warmer zeal
United, centre in the public weal!
Fain would my muse discharge the debt of praise,
With fresh addition to thy circling bays.

Learning, the glory of Britannia's isle,
Within thy fav'rite leaves are taught to smile,
No more perplex'd in error's maze we run,
And meet the danger which we sought to shun:
Since drawn by thee, now shines before our eyes,
The path were virtue and fair knowledge lies:
There waits a * Guide, by nicest model plann'd,
Here stands an usher with assisting hand;
A work so clear, delighted we pursue,
And think the pleasing prospect ever new.

So the kind sun, with all reviving ray,
Cheers the dark world with an approaching day:
Before his light the empty shadows fly,
And nature glows with a serener sky.

WILLIAM DEANE.

* Referring to that of the English Tongue.

Halifax, Oct. 20, 1765.

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The Explication of some Marks used in this Compendium.

= TWO parallel lines are the marks of Equality; as 12 oz. 1=lb. signifies that 12 ounces are equal to 1 pound.

+ Saint George's cross signifies more, or addition, as 4+2 =6: i. e. 4 more 2, are equal to 6.

— A strait line signifies less, or subtraction; as 4—2=2: i. e. 4 less 2, are equal to 2.

× Saint Andrew's cross, denotes Multiplication; as 4×2 =8 i. e. 4 multiplied by 2, are equal to 8.

÷ ⁘ A line between two points, or between four points, is the sign of division; as 4÷2 or 4⁘2=2: i. e. divided by 2, are equal to 2.

)(The reversed parenthesis denotes division also; as 2)4(2: i. e. 4 divided by 2, is equal to 2.

$\frac{4}{2}\frac{6}{3}\frac{1}{2}$ Numbers placed in a fraction-like manner, do likewise denote division; the lower number being the divisor, and the upper number the dividend.

:: Four points, set in the middle of four numbers, denote them to be proportional to one another, by the rule of three; as 2 .. 4 :: 8 .. 16: that is, as 2 is to 4, so is 8 to 16.

N. B. Some masters instead of points use long strokes to keep the terms separate, but it is wrong to do so; for the two points between the first and second terms and also between the third and fourth terms, shew that the two first and the two last terms are in the same proportion. And whereas four points are put between the second and third terms, they serve to disjoint them, and shew that the second and third, and first and fourth terms, are not in the same direct proportion to each other as are those before mentioned.

Explication of some Marks, &c.

MONEY.

L. Libræ, Pounds.
S. Solidi, Shillings.
D. Denarii, Pence.
Qrs. Quadrantes, Farthings.

$2+3\times5=25$, signifies that the sum of 2 and 3 multiplied by 5, is equal to 25.

$3-2\times5=5$, signifies that the difference between 3 and 2 multiplied by 5, is equal to 5.

$\surd$ or $\surd q$ Prefixt to any number, supposes that the square root of that number is required. Sometimes it is the sign of irrationality, and signifies that the square root of such a number can never be truly found.

$\surd c$. Prefixt to any number, supposes that the cube root of that number is required. Sometimes it is the sign of irrationality, and signifies that the cube root of such a number, can never be truly found.

$3aa+3a$, Signifies 3 times the square of a, more 3 times a.

$3aac+3eea+eee$, Signifies 3 times the square of a, multiplied by e; more 3 times the square of e, multiplied by a, more the cube of e, as in the cube root.

THE

SCHOOLMASTER'S

ASSISTANT.

PART I.

Of Arithmetic in Whole Numbers.

INTRODUCTION.

OF ARITHMETIC IN GENERAL.

Q. WHAT is Arithmetic?

A. Arithmetic is the Art or Science of computing by numbers, either whole or in fractions.

Q. What is number?

A. Number is one or more quantities, answering to the question, how many?

Q. What is arithmetic in whole numbers?

A. Arithmetic in whole numbers, or integers, supposes its numbers to be entire quantities, and not divided into parts.

Q. What is arithmetic in fractions?

A. Arithmetic in fractions, supposes its numbers to be the parts of some entire quantity.

Q. How do you consider arithmetic with regard to art and science?

A. Both in theory and practice.

Q. What is theoretical arithmetic?

A. Theoretical arithmetic considers the nature and quality of numbers, and demonstrates the reason of practical operations. And in this sense arithmetic is a science.

Q. What is practical arithmetic?

A. Practical arithmetic is that which shews the method of working by numbers, so as may be most useful and expeditious for business. And in this sense arithmetic is an art.

Q. What is the nature of all arithmetical operations?

A. The nature of all arithmetical operations is, by some quantities that are given, to find out others that are required.

Q. What are the fundamental rules in arithmetic?

A. These five: Notation, Addition, Subtraction, Multiplication, and Division.

OF NOTATION.

Q. WHAT is Notation?

A. It is the art of expressing numbers by certain characters or figures.

Q. What is the use of notation?

A. Notation teaches us to read and write numbers by their true value.

Q. How many sorts of characters or figures are numbers usually expressed by?

A. Two, viz. The Arabic figures and the Latin letters.

Q. How are the Arabic figures expressed?

A. The Arabic figures are thus expressed; one 1, two 2, three 3, four 4, five 5, six 6, seven 7, eight 8, nine 9, nought, or cypher 0. And this is the notation or reading and writing of every single figure.

Q. How far may the use of these figures be extended?

A. These ten characters or figures may be used to express all manner of numbers, from the least to the greatest, that can be conceived; even without end.

Q. How many figures are sufficient to express most ordinary concerns.

A. Nine; and therefore the table of notation commonly extends no farther than nine places.

Q. Why does it consist of nine places rather than of eight or ten?

A. Because they make up three even periods.

Q. What do you mean by a period?

A. A period is a quantity expressed by three figures, whereof the first to the right hand signifies so many units or single things; the second so many tens; and the third so many hundreds.

Q. Why are three figures called a period?

A. Because, if the number be increased above three places, there is still the same periodical return of the value of those places, and every third figure to the left hand will always be hundreds, if it be ever so far extended.

Q. Is an unit or one, a number?

A. An unit is a number, because it may properly answer the question, how many?

Q. Give me an example or two?

A. How many gods do we believe? the answer is one. How many Sundays in the compass of a week? Answ. One.

Q. In what nature or proportion of value, do numbers increase from the unit's place to the left hand?

A. By ten.

Q. How must they be read?

A. From the left to the right hand.

Q. If two figures are given to be read together, how must they be valued?

A. The first figure towards the right hand is units, and the next to that is so many tens; as 89, eighty-nine. Where 9 is in the place of units, and 8 is in the place of tens; for eight tens are properly called eighty.

Q. If three figures or a whole period be given, how is it to be valued?

A. Beginning at the last figure on the right hand, I value them units, tens, hundreds; as 789, seven hundred and eighty-nine.

Note, 1. As every third figure from the place of units, bears the name of hundreds; so for any great sum to be distinguished into periods, (as in the following tables) will be of good use to the learner, in the easier valuing and expressing that sum. 2. There is also another sort of periods, which some distinguish thus, viz. millions, millions of millions, &c. and others thus, viz. millions, billions, trillions, &c. each period consisting of 6 places; but as periods of this kind seldom or never occur in business, it is sufficient only to mention them in this place, without saying any thing further about them.

TABLE I.

Third Period { C millions	X millions	millions	Sec'd Period { C thous.	X thous.	thousands.	First Period { hundreds	tens	units
								9
							8	9
						7	8	9
					9	7	8	9
					8	9	7	8	9
				7	8	9	7	8	9
		9	7	8	9	7	8	9
	8	9	7	8	9	7	8	9
	9	7	8	9	7	8	9	

TABLE II.

Third Period { C millions	X millions	millions	Sec'd Period { C thous.	X thous.	thousands	First Period { hundreds	tens	units
								4
							7	3
						9	6	5
					3	4	7	2
				4	8	9	1	6
			7	3	1	2	3	6
		3	1	2	7	1	4	8
	4	3	1	9	2	7	6	4
5	7	3	1	2	9	8	4	2

...tion of numbers by Latin letters, in the New Guide to the La-

EXAMPLES FOR PRACTICE.

Write down in proper figures the following numbers, v

Twenty-nine.

Three hundred and forty-eight.

Seven thousand, two hundred and twenty-six.

One thousand, three hundred and ninety.

Nineteen thousand, seven hundred and twenty-eight.

Four hundred and twenty-seven thousand, three hund and ninety-six.

Nine hundred and forty-two thousand, seven hundred.

Four millions, seven hundred and eighty-nine thousa three hundred and twenty-eight.

Seven millions, nine hundred and forty-two thousand, f hundred and seventy-five.

Twenty-six millions, three hundred and fourteen th sand, one hundred and ninety-five.

One hundred and ninety-seven millions, four hundred thirty-six thousand, one hundred and ninety-one.

Seven hundred and fourteen millions, one hundred nineteen thousand, seven hundred and four.

Write down in words at length the following numbers,

7	7428	7126172
19	61261	74680218
846	370121	461272615

OF ADDITION.

Q. WHAT is the use of addition?

A. Addition teacheth to bring several pa cular numbers into one total sum.

Q. How many sorts of addition are there?

A. Two, viz. simple and compound.

OF SIMPLE ADDITION.

Q. What is simple addition!

A. Simple or single addition, is the adding of seve numbers together, whose signification is the same; 6 yards and 8 yards make 14 yards.

Q. If several numbers are given to be added into sum, how are they to be placed?

A. They must be placed in such manner, that u may stand under units; tens under tens, &c. pounds der pounds, shillings under shillings, &c.

Q. How do you prove addition?

A. The best way of proving addition is to begin at top of the sum, and reckon the figures downwards in same manner that they were added upwards: an *second* line or sum total be equal to the first, i

Examples for Practice.

L.	*Yds.*	*Gals.*	*Tons.*	*Hhds.*	*lb.*
4	43	764	3746	47476	461743
7	27	347	7436	73712	761780
3	39	387	3406	31819	476332
2	13	736	7398	41243	126722
3	37	397	3373	71208	310748
7	46	473	4731	79956	571388
6	23	382	2264	81465	704714
4	59	769	4731	31269	312624
7	94	367	7169	74196	781462

Miles.	*Leagues.*	*Years.*
4734736	46431734	346312484
3474312	71261374	168126313
2546325	92652724	718125191
7369138	86337266	731618191
3143618	74147312	312134716
4733216	47312514	873263298
2473347	27467573	312614712
3712612	31216126	976647829
5726384	39874129	312814795

OF COMPOUND ADDITION.

Q. What is compound Addition?

A. Compound Addition is the adding of several Numbers together, having divers Denominations.

I. Of Money.

Q. Which are the Denominations of English Money?

A. 4 Farthings make 1 Penny.
12 Pence —— 1 Shilling.
20 Shillings —— 1 Pound Sterling.

Q. Are there no other names of Money used in England?

A. Yes; such as,

	l.	*s.*	*d.*
A Moidore	= 1	7	0
A Guinea	= 1	1	0
A Half Guinea	= 0	10	6
A Crown	= 0	5	0
A Half Crown	= 0	2	6

There are also several smaller pieces which speak their own value, as a six-pence, four-pence, three-pence, two-pence, penny, half-penny, and farthing.

Note, The following Pieces were formerly Current, b now not so, being only imaginary.

	l.	*s.*	*d.*
A Jacobus =	1	5	0
A Carolus =	1	3	0
A Mark =	0	13	4
An Angel =	0	10	0
A Noble =	0	6	8

The pound Sterling is also an imaginary sum.

Q. Are there not some tables that may be learn by heart?

A. Yes; the following, called Pence tables.

d.		*s.*	*d.*		*s.*		*d.*
20	=	1	8		2	=	24
30	=	2	6		3	=	36
40	=	3	4		4	=	48
50	=	4	2		5	=	60
60	=	5	0		6	=	72
70	=	5	10		7	=	84
80	=	6	8		8	=	96
90	=	7	6		9	=	108
100	=	8	4		10	=	120
110	=	9	2		11	=	132
120	=	10	0		12	=	144

Note 1. *Tho' I say these tables may be learnt by he I do not say they must, for then, by the same rule, it wo be necessary to have tables to every rule in addition, wh nobody uses, and not every one the pence tables; beca when they are learnt ever so perfectly, their use extend farther than money; and therefore, they may very well omitted, and a better method substituted in their room mean that of pointing, which, I am sure, is both easier safer, to beginners especially. However, I chuse to them down in their place, that they, who approve of th may use them; and they who do not, can easily omit the*

2. *As all the parts of addition are built upon the s reason; so the method of pointing may serve as a gen rule, when any denomination is to be added; and this be done without defacing the figures.*

Examples.

L.	s.	d.
4	3	6
1	7	$8\frac{1}{4}$
2	7	4
1	9	$4\frac{1}{2}$
3	1	$3\frac{1}{4}$
1	2	1
4	7	$6\frac{1}{2}$
3	1	9

L.	s.	d.
1	1	3
3	8	$1\frac{1}{4}$
1	1	6
3	4	$7\frac{1}{2}$
1	2	6
3	2	$8\frac{1}{4}$
7	4	6
4	1	$7\frac{3}{4}$

L.	s.	d.
4	1	$6\frac{1}{4}$
1	2	7
3	1	$4\frac{1}{2}$
3	3	6
1	4	$1\frac{1}{2}$
3	1	2
1	5	$8\frac{1}{2}$
3	1	2

L.	s.	d.
14	12	1
17	11	$2\frac{3}{4}$
19	12	$1\frac{1}{2}$
16	13	$1\frac{3}{4}$
12	13	6
14	12	$7\frac{3}{4}$
19	13	4
12	11	6

L.	s.	d.
19	13	4
12	11	6
17	14	$1\frac{1}{4}$
19	13	$4\frac{1}{2}$
12	11	6
19	13	$1\frac{3}{4}$
16	12	1
19	11	$2\frac{1}{4}$

L.	s.	d.
47	12	11
17	10	11
17	10	$4\frac{1}{2}$
32	12	6
11	19	4
12	12	$6\frac{3}{4}$
11	13	1
11	11	$2\frac{1}{4}$

L.	s.	d.
21	12	$10\frac{1}{2}$
31	11	$11\frac{1}{2}$
47	12	$10\frac{1}{4}$
19	11	4
31	12	$6\frac{1}{2}$
12	11	$4\frac{3}{4}$
37	11	4
19	11	3

L.	s.	$\frac{1}{6}$ d.
12	13	10
71	16	8
19	4	$6\frac{1}{4}$
12	3	1
26	1	6
31	11	1
14	12	$6\frac{3}{4}$
18	12	7

L.	s.	d.
44	12	$6\frac{1}{4}$
31	18	$1\frac{1}{2}$
47	12	4
14	12	$10\frac{3}{4}$
17	14	11
19	12	2
16	11	3
17	11	$1\frac{1}{4}$

L.	s.	d.
21	11	$11\frac{1}{2}$
16	12	6
11	9	$10\frac{1}{2}$
16	12	$4\frac{1}{4}$
34	1	10
17	14	$11\frac{1}{4}$
71	3	$8\frac{3}{4}$
16	1	4

L.	s.	d.
47	12	$6\frac{1}{4}$
16	19	$11\frac{3}{4}$
17	12	$10\frac{1}{4}$
19	12	10
17	12	$11\frac{3}{4}$
17	19	$4\frac{1}{2}$
47	13	6
72	18	6

L.	s.	d.
47	11	$3\frac{1}{4}$
31	17	3
17	12	$11\frac{3}{4}$
18	14	$10\frac{1}{2}$
16	15	11
17	14	$3\frac{1}{4}$
11	11	6
17	17	3

A Mercer's Bill.

Bought of George Bailey, May 17, 1781.

		s.	d.		L.	s.	d.
9	Yards of Silk - - at	14	6	per Yd.	6	10	6
12	Yards of flower'd Silk at	16	8	——	10	0	0
16	Yards of Sarsenet - at	6	9	——	5	8	0
10	Yards of Sattin - - at	9	6	——	4	15	0
15	Yards of Brocade - at	10	8	——	8	0	0
11	Scarves - - - - at	2	0	each	1	2	0
14	Yards of Genoa Velvet at	17	4	per Yd.	12	2	8
10	Yards of Lustring - at	5	2	——	2	11	8
				Sum			

A Woollen Draper's Bill.

Bought of Thomas Simmons, June 19, 1781.

		s.	d.		L.	s.	d.
16	Yards of Drugget - - at	7	0	per Yd.	5	12	0
12	Yards of Broad-Cloth - at	15	0	——	9	0	0
9	Yards of Black-Cloth - at	16	5	——	7	7	9
10	Yards of Shalloon - - at	1	8	——	0	16	8
15	Yards of Serge - - - at	1	10	——	1	7	6
7	Yards of fine Spanish Black at	18	0	——	6	6	0
16	Yards of Frize - - - at	4	6	——	3	12	0
12	Yards of Superfine Scarlet	18	0	——	10	16	0
				Sum			

A Linen Draper's Bill.

Bought of John Clay, July 17, 1781.

		s.	d.		L.	s.	d.
26	Ells of Dowlas - - - at	1	4	per Ell	1	14	8
18	Ells of Holland - - at	4	0	——	3	12	0
12	Ells of Diaper - - - at	1	0	——	0	12	0
12	Damask Napkins - - at	2	0	each	1	4	0
20	Yards of printed Linen at	2	0	per Yd.	2	0	0
10	Yards of Cambric - - at	12	0	——	6	0	0
10	Yards of Muslin - - at	7	0	——	3	10	0
14	Yards of Canvas - - at	3	8	——	2	6	4
				Sum			

A Grocer's Bill.

Bought of Thomas Hartley, May 19, 1781.

		s.	d.		L.	s.	d.
8 lb.	of Raisins of the Sun	at 0	5	per lb.	0	3	4
15 lb.	of Malaga Raisins	at 0	4½	——	0	5	7½
10 lb.	of Currants - - -	at 0	6½	——	0	5	5
11 lb.	of Sugar - - - -	at 0	4½	——	0	4	1½
2	Sugar Loaves, wt. 15 lb.	at 0	9	——	0	11	3
13 lb.	of Rice - -	at 0	3	——	0	3	3
5 lb.	Black Pepper -	at 1	6	——	0	7	6
10 Oz.	of Cloves. -	at 0	10	per oz.	0	8	4

Sum

A Cheesemonger's Bill.

Bought of Daniel Bridge, July 17, 1781.

		s.	d.		L.	s.	d.
3	Gloucester Cheeses, wt. 24 lb.	at 0	4	per lb.	0	8	0
3	Warwickshire - wt. 20 lb.	at 0	3	——	0	5	0
1	Cheshire - wt. 28 lb.	at 0	4	——	0	9	4
½	Firkin of Butter - wt. 28 lb.	at 0	6	——	0	14	0
1	Flitch of Bacon - wt. 6 Sto.	at 4	0	per sto.	1	4	0
7 lb.	of Cambridge Butter -	at 0	6	per lb.	0	3	6
9 lb.	of new Cheese - -	at 0	4	——	0	3	0
7 lb.	of Cream Cheese - -	at 0	6	——	0	3	6

Sum

A Milliner's Bill.

Bought of John Inman, August 28, 1781.

		s.	d.		L.	s.	d.
15	Yards of Silver Ribbon -	at 2	3	per yd.	1	13	9
3	Pair of fine Kid Gloves	at 2	0	per pair	0	6	0
6	Doz. of Irish Lamb ditto	at 1	0	——	3	12	0
6	Sarsenet Hoods - -	at 4	6	each	1	7	0
15	Fans, Indian Mounts -	at 4	0	——	3	0	0
3	Setts of Knotts - -	at 2	0	per sett	0	6	0
16	Yards of Fine Lace - -	at 10	0	per yd.	8	0	0
20	Pieces of Bobbin - -	at 0	6	pr. piec.	0	10	0

Sum

A Carpenter's Bill.

Mr. John Law, Dr. to John Brooks, for Carpenter's Work and Materials, viz.

1781		s.	d.		L.	s.	d.
May 3	For 30 Feet of Fir Timber at	0	3	pr. foot	0	7	6
5	— 18 whole Deals - at	1	6	each	1	7	0
	— 16 slit deals - - at	1	0	——	0	16	0
	— 4 Hundred of six-penny Nails ——				0	2	0
	— 3 Hundred of ten-penny Nails ——				0	2	6
	— 6 Hundred of Brads - ——				0	1	6
	— 18 Days Work at	3	0	per day	2	14	0
				Sum			

A Baker's Bill.

Mr. Thomas Marriot, Dr. to James Barnet, viz.

1781		L.	s.	d.
Feb. 4.	For a peck of Bran - -	0	0	8
	— a Fine Peck Loaf - -	0	1	8
13	— a Peck of Fine Flour - -	0	1	8
17	— a Bushel of Polland - -	0	1	0
18	— Small Bread - -	0	0	$2\frac{1}{2}$
	— Yeast - - - -	0	0	1
	— a half Peck second Loaf -	0	0	9
20	— a quarten second Loaf - -	0	0	$4\frac{1}{2}$
			Sum	

A Bill of disbursement.

1781		L.	s.	d.
Feb. 17	Laid out in Lamb, seven Groats -			
18	—— in Sallad, five Farthings - -			
21	—— in Beef, nineteen pence half-penny			
Mar. 7	—— in Parsnips, three half-pence -			
8	—— in Potatoes, a groat - -			
9	—— in Candles, seven Groats and Three-pence			
10	—— in Butter and Cheese, eight and twenty-pence			
20	—— in Bread, three and twenty-pence			
			Sum	

Suppose I am indebted	*L.*	*s.*	*d.*
To A, Twenty pounds seven shillings and four pence farthing - - - -			
— B, Nineteen pounds, thirteen shillings and ten pence half-penny - -			
— C, Twelve pounds, fourteen shillings and seven pence three farthings -			
— D, Twenty-six pounds, seventeen shillings and four pence farthing - -			
— E, Twenty-eight pounds, thirteen shillings and seven pence three farthings			
— F, Twenty-one pounds, fifteen shillings and five pence half-penny - -			
— G, Five pounds, six shillings and seven pence farthing - -			
How much is the debt? Sum			

2. OF TROY-WEIGHT.

Q. Which are the denominations of Troy-Weight?

A. 24 Grains, or gr. make 1 Penny-weight dwt.
20 Penny-weights - 1 Ounce, oz.
12 Ounces - - - - 1 Pound, lb.

Q. What sort of things, are weighed by this Weight?

A. Gold, Silver, Jewels, Electuaries and all Liquors.

Q What is the standard for Gold?

A. 22 Carrats of fine Gold, and two Carrats of Copper being melted together, are esteemed the true standard for Gold Coin.

Q. What is a Carrat?

A. A. Carrat is not any certain Quantity or Weight, but the twenty-fourth part of any Quantity or Weight.

Q. What is the standard for Silver?

A. 11. oz. 2 dwts. of fine Silver, and 18 dwts. of Copper being melted together, are esteemed the true standard for silver Coin; called silver Sterling.

Note. The ounce of silver being valued at 5 shillings, one Penny-weight will be valued at three Pence, and the Grain at Half a Farthing.

EXAMPLES.

Oz.dw.gr.	*Oz.dw.gr.*	*lb.oz.dw.gr.*	*lb.oz.dw.gr.*
7 10 12	7 13 12	4 10 12 11	7 10 12 10
6 11 12	6 11 14	3 11 16 12	3 4 16 13
5 16 11	9 12 17	1 4 16 19	3 7 12 12
4 16 10	4 16 13	3 3 11 17	1 1 18 16
1 12 16	7 11 14	4 1 16 14	4 11 16 12
7 12 18	6 19 12	3 3 16 11	4 3 16 21
9 16 19	7 13 16	7 11 16 10	3 3 13 11
8 14 16	3 19 14	6 4 13 15	8 7 18 19
4 16 10	5 9 8	5 11 14 13	9 8 19 9
9 4 8	6 12 13	9 10 15 14	9 11 12 8

3. OF AVOIRDUPOIS-WEIGHT.

Q. Which are the denominations of Avoirdupois-Weight?

A. 16 Drams, or dr. make 1 Ounce, oz.
16 Ounces ——— 1 pound, lb.
28 Pounds ——— 1 quarter of an Hund. Wt. qr.
4 Quarters ——— 1 Hund. Wt or 112 Pounds, C.
20 Hundred Wt. —— 1 Ton, T.

Q. What is the use of Avoirdupois-Weight?

A. Avoirdupois-Weight is used in Weighing any thing of a coarse and drossy nature, as all Grocery and Chandler's Wares, and all metals, but silver and gold.

Note. Bread formerly was weighed by Troy-Weight but is now at London weighed by this weight.

Q. What is the difference between a pound Avoirdupois and a pound Troy?

A. The pound Avoirdupois is eqaul to 14 oz. 11 dwt. 15 gr. and an half Troy: and the pound Troy is equal to 13 oz. 2 dr. and an half, and $\frac{9323}{13999}$ Avoirdupois.

Q. What other denominations are there in this weight?

A. There are several other denominations in Avoirdupois-Weight, in some particular Goods, and others only customary in some particular places; as appears by the following table.

TABLE.

	lb.		lb.
A Firkin of Butter -	56	A burden of Gad Steel, or 9 score is	180
—— of Soap is - -	64	A quintal of Fish in Newfoundland is	100
A Barrel of Pot Ash is	200	A stone of Glass is -	5
—— Anchovies is -	30	A seam of Glass 24 stone, or	120
—— Candles is - - -	120	For Cheese and Butter.	
—— Figs from - to 2 C. 3 qrs.	98	A clove or half stone is	8
—— Soap is - - -	256	A Wey in Suffolk is 32 Clove, or	256
—— Butter is - - -	224	—Essex is 42 cloves, or	336
—— Gunpowder is -	112	For Wool.	
—— Raisins is - - -	112	A Clove is - -	7
A double barrel of Anchovies is	60	A Stone is - -	14
A puncheon of Prunes is 10 C. or 12 C.		A Tod is - - -	28
A fother of Lead is 19 C. 2qrs.		A Wey is 6 Tod and 1 stone or	182
A stone of Iron or Shot is	14	A Slack is 2 Weys, or	364
—— Butcher's Meat is -	8	A Last is 12 Sacks, or	4368
A gallon of Train Oil is	7½		
A faggot of Steel is -	120		

Examples.

T.	*C.*	*qr.*	*lb.*	*C.*	*qr.*	*lb.*	*lb.*	*oz.*	*dr.*	*lb.*	*oz.*	*dr.*
7	11	1	16	17	1	12	14	10	12	12	11	10
1	12	3	11	16	2	11	16	12	11	17	12	10
3	4	1	17	14	1	12	19	12	12	14	12	13
3	1	2	12	16	3	19	17	12	13	16	12	11
7	11	1	11	19	1	12	11	10	10	19	12	11
6	3	2	13	16	3	18	16	15	14	17	13	4
3	1	2	20	12	1	18	13	11	14	16	11	3
4	1	3	26	16	3	19	17	12	10	21	10	7

4 OF APOTHECARIES-WEIGHT.

Q. Which are the denominations of Apothecaries-Weight?

A. 20 Grains, or gr. make 1 Scruple, ℈.
3 Scruples —— 1 Dram. ʒ.
8 Drams —— 1 Ounce, ℥.
12 Ounces —— 1 Pound, ℔.

Q. What is the use of Apothecaries-Weight?

A. Apothecaries-Weight is such as their medicines are compounded by.

Note 1. The Apothecaries mix their Medicines by this Rule, yet buy and sell their commodities by Avoirdupois-Weight.

2. The Apothecaries Pound and Ounce and the Pound and Ounce Troy, are the same, only differently divided and subdivided.

EXAMPLES.

lb	℥	ʒ	℈	gr.	lb	℥	ʒ	℈	gr.	lb	℥	ʒ	℈	gr.
3	11	7	2	19	7	1	1	1	10	7	3	1	2	11
1	0	4	1	13	0	1	1	1	14	6	2	7	1	14
0	1	7	2	12	7	3	4	1	12	3	7	2	1	11
1	2	6	2	11	6	1	1	2	11	1	3	1	0	10
2	1	3	1	12	0	0	3	2	17	2	1	2	1	12
1	2	4	0	11	0	1	0	0	10	1	2	1	2	11
7	10	3	1	16	0	1	2	0	10	4	3	1	2	11
1	7	6	1	15	0	3	7	2	19	7	3	2	1	13

5 OF LONG-MEASURE.

Q. Which are the denominations of Long-Measure?

A. 3 Barley-corns, or B. c. make 1 Inch, In.
4 Inches —— 1 Hand, Hd.
12 Inches —— 1 Foot, Ft.
3 Feet —— 1 Yard, Yd.
6 Feet —— 1 Fathom, Fa.
5 Yards and $\frac{1}{2}$ —— 1 Rod, Pole, or perch, po.
40 Poles. —— 1 Furlong, Fu.
8 Furlongs —— 1 Mile, M.
3 Miles —— 1 League, L.
60 Miles —— 1 Degree, Deg.

Note. A Degree is 69 Miles and 4 Furlongs, very near, though commonly reckoned but 60 Miles.

Q. What is the use of Long-Measure?

A. To measure distances of places, or any thing else, where length is considered, without regard to the breadth.

Q. Is the Pole or Perch always of the same length?

A. No.

Q. What is the difference?

A. Five Yards and a half are the statute measure for a Pole or Perch; but for Fens and Woodlands it is customary *to reckon* 18 feet to the Pole: and for Forests 21 feet.

Q. What is the use of an Hand?
A. It is used to measure horses.
Q. What is the use of a Fathom?
A. It is used to measure depths.

EXAMPLES.

M. f. p.	*Yds. f. in.*	*Le. m. f. p.*	*Yds. f. in. bc.*
17 7 19	14 2 7	17 2 6 14	16 1 0 0
16 1 14	16 0 4	12 1 2 18	14 2 10 1
19 3 16	19 1 10	16 2 1 16	17 1 4 2
17 4 19	16 2 4	19 2 7 11	13 2 11 1
12 1 11	14 2 5	19 0 4 31	16 1 7 2
18 3 16	14 2 1	17 1 1 12	17 1 4 1
19 7 14	11 1 3	12 1 2 17	19 2 6 2
16 1 2	11 0 1	17 1 1 14	19 2 1 26

6 OF CLOTH-MEASURE.

Q. Which are the denominations of Cloth-Measure?
A. 2 Inches, or in. and a quarter make 1 Nail, N.
4 Nails — — 1 Qr. of a Yd. qr.
4 Quarters — — 1 Yard, Yd.
3 Quarters of a yard — 1 Flemish Ell, E.F.
5 Quarters of a yard — 1 English Ell.

Note 1. The yard is used in measuring all sorts of woollen cloths, wrought silks, most linens, tape and gartering.

2. The Ell English is used only in measuring some particular linens called Hollands.

3. The Ell Flemish is used in measuring tapestry.

EXAMPLES.

Yds. qrs. na.	*Ells. qrs. na.*	*Yds. qrs. na.*	*E. F. qrs. na.*
17 1 1	14 1 2	17 2 0	17 1 2
11 3 1	17 3 0	16 3 3	17 1 3
16 1 2	14 4 0	17 1 2	14 1 2
19 3 1	16 3 2	19 2 0	16 2 0
17 1 2	19 1 1	17 3 2	14 0 0
12 3 3	17 2 3	16 1 3	19 2 1
12 1 1	16 3 1	19 2 1	17 2 2
14 2 3	15 1 2	17 1 2	16 1 3

7. OF LAND-MEASURE.

Q. Which are the Denominations of Land-Measure?

A. 9 Square feet, or Ft. —— make 1 Yard, Yd.
30 Yards and a quarter —— 1 Pole, Po.
40 Poles in length and one in Breadth, 1 Rood, R.
4 Roods —— 1 Acre, A.

Q What is the use of Land-Measure?

A. It gives the contents of any peice of ground in acre

EXAMPLES.

A.	*r.*	*p.*	*A.*	*r.*	*p.*	*A.*	*r.*	*p.*
17	3	12	17	1	12	26	1	36
11	2	11	11	3	13	18	2	22
15	1	21	16	3	27	23	3	13
16	1	12	19	1	15	26	2	28
27	2	18	12	3	14	33	2	33
23	2	28	26	2	20	19	0	29
29	3	17	27	3	24	33	3	26
20	3	20	22	2	20	27	2	24

8. OF LIQUID-MEASURE.

Q. How many sorts of Liquid-measure are there?

A. Two: Wine-measure and Winchester-measure.

Q. What is meant by Winchester-measure?

A. It is a particular measure used for beer and ale.

Q. What is the difference between Wine-measure ar Winchester-measure.

A. A gallon of wine is 234 solid inches; but a gallc of beer or ale exceeds that measure by 52 inches, and 282 solid inches.

(1) OF WINE-MEASURE.

Q. Which are the denominations of Wine-measure?

A. 2 Pints, or pts. make 1 Quart, qt.
4 Quarts 1 Gallon, gal.
10 Gallons 1 Anchor of Brandy or Rur
18 Gallons 1 Runlet, R. [A
31½ Gallons 1 Barrel, Bar.
42 Gallons 1 Tierce, T.
63 Gallons 1 Hogshead, Hhd.
84 Gallons 1 Puncheon, Pun.
2 Hogsheads 1 Pipe or Butt. P.
2 Pipes or 4 Hhds. 1 Tun, T.

Q. What other Liquors are measured by the Wine Standard?

A. All Brandies, Spirits, Strong Waters, Perry, Cyder, Mead, Vinegar, Honey and Oil.

Note. Milk is also retailed by this Standard, not by Law, but Custom only.

EXAMPLES.

T. hhds.	*gal.*	*qts.*		*Hhds.*	*gal.*	*qts.*		*Tier.*	*gal.*	*qts.*
7	1	12	2	27	10	2		27	12	1
6	3	31	2	23	13	3		29	17	3
7	1	41	2	26	11	3		22	11	2
6	2	17	1	29	12	2		27	31	4
7	3	14	3	23	22	0		29	12	1
1	2	19	1	27	32	2		27	11	2
9	1	14	2	29	27	3		26	17	1
3	1	15	2	26	33	2		22	11	3

(2) OF WINCHESTER-MEASURE.

Q. Which are the Denominations of Winchester-Measure?

A. 2 Pints, or pts. make 1 Quart, qt.
4 Quarts 1 Gallon, gal.
8 Gallons 1 Firkin of Ale, Fir.
9 Gallons 1 Firkin of Beer, Fir.
2 Firkins 1 Kilderkin, Kil.
4 Firkins 1 Barrel, Bar.
Barrel & a half, or 54 Gal. 1 Hogshead of Beer, hhd.

Q. What is the difference between Ale & Beer-measure?

A. In London only they compute 8 Gallons to the Firkin of Ale, and 32 Gallons to the Barrel; but in all other parts of England, for Ale, Strong Beer, and Small Beer, 34 Gallons, are computed to the Barrel, and 8 Gallons, and an half to the Firkin.

Q. What other commodities are there, that go by the Winchester-Measure?

A. A Barrel of Salmon or Eels is 42 Gallons,
A Barrel of Herrings 32 Gallons,
A Keg of Sturgeon 4 or 5 Gallons,
A Firkin of Soap 8 Gallons.

EXAMPLES.

Hhds.	*gal.*	*qts.*	*B.B.fir.*	*gal.*		*Hhds.*	*gal.*	*qts.*	*A.B.fir.*	*g*
7	12	1	23	3	3	26	17	1	23	1
6	27	2	27	2	6	13	19	2	24	2
3	21	2	29	3	7	21	16	3	27	1
2	11	1	27	2	8	31	18	2	27	3
3	17	2	26	1	5	27	10	1	26	3
2	12	1	27	1	4	31	18	2	27	1
6	17	3	27	1	3	26	31	1	26	2
7	31	2	32	2	2	31	26	2	29	1

9. OF DRY-MEASURE.

Q. Which are the usual Denominations of Dry-Measur

A. 2 Pints, or pts. make 1 Quart, qt.
2 Quarts 1 Pottle, pot.
2 Pottles 1 Gallon, gal.
2 Gallons 1 Peck, P.
4 Pecks 1 Bushel, Bush.
8 Bushels 1 Quarter of Corn, qr.
36 Bushels 1 Chaldron of Coal, Ch.

Q. Wherein does London differ from other places England in the Coal-Measure?

A. In London 36 Bushels make a Chaldron; but all other places 32 Bushels make a Chaldron. T Bushel also in water-measure contains 5 pecks.

Q. What other denominations are there in Dry-Measur

A. A Score of Coals is 21 Chaldrons.
A Sack of Coals 3 Bushels.
A Sack of Corn 4 Bushels.
5 Quarters of Corn make 1 Wey.
2 Weys 1 Last.
A Load of Corn 5 Bushels.
A Cart-load ditto 40 Bushels.

Q. What is the use of Dry-Measure?

A. Dry-Measure is applied to all dry goods, as co seeds, fruits, roots, sand, salt, sea coal, charcoal, sm coal, oysters, muscles, and cockles.

Q. What is the standard for Dry-Measure?

A. The standard for Dry-Measure is a Winchest Bushel, being 18 inches and a half wide throughout a 8 inches deep. One gallon of this quantity is 280 so Inches and $\frac{4}{5}$, and consequently is less than an Ale g *ion by 18 solid* inches and $\frac{1}{5}$.

EXAMPLES.

Ch.	*bu.*	*ft.*	*Qrs.*	*bu.*	*ft.*	*Ch.*	*bu.*	*ft.*	*Qrs.*	*bu.*	*ft.*
17	11	3	14	7	2	27	10	1	36	7	3
16	10	2	16	1	1	17	12	2	43	6	2
19	11	1	19	3	2	24	21	1	22	3	3
17	12	3	16	1	1	31	32	2	37	3	2
16	19	3	17	3	2	71	19	1	26	5	2
17	11	1	16	1	1	16	12	2	28	4	3
17	11	3	12	3	1	17	31	3	33	7	0
11	14	1	87	2	3	16	14	1	42	3	2

10. OF TIME.

Q. Which are the denominations of Time?

A. 60 Seconds, or Sec. make 1 Minute, Min.
60 Minutes, 1 Hour, Hr.
24 Hours, 1 Day, Da.
7 Days, 1 Week. Wk.
4 Weeks, 1 Month, Mo.
13 Months, 1 day & 6 hours 1 common or Julian Year, Yr.

Q. What is a Solar Year?

A. According to the best Computation, a Solar Year is 365 Days, 5 Hours, 48 Minutes, and 55 Seconds.

Q. How is the year divided by the Calender?

A. No more days than 30 hath th' Month of September.
The same may be said of June, April November;
The rest of the Months have just 30 and one,
Except that short Month February alone,
Which to itself claimeth just 8 and a score,
But in ev'ry Leap-Year we give it one more.

EXAMPLES.

M.	*w.*	*d.*	*H.*	*m.*	*sec.*	*M.*	*w.*	*d.*	*D.*	*h.*	*m.*	*sec.*
14	1	6	17	10	32	31	2	1	17	11	13	16
17	2	5	17	22	21	17	1	6	19	12	10	11
16	1	3	14	21	32	17	3	4	17	12	17	13
19	3	2	4	2	3	16	1	1	14	13	26	31
16	1	1	7	3	1	17	2	1	13	12	11	48
26	2	0	73	16	30	16	2	5	17	19	19	12
13	2	2	22	28	42	19	1	4	13	23	26	51

11. OF MOTION.

Q Which are the Denominations of Motion in th heavenly Bodies?

A. 60 Seconds, or " make 1 Prime Minute, '.
60 Minutes 1 Degree, °.
30 Degrees 1 Sign.
12 Signs, or 360 Degrees, make the who great Circle of the Zodiac.

EXAMPLES.

°	'	"	°	'	"	°	'	"
71	10	16	47	17	19	46	17	31
12	11	19	17	10	38	17	86	18
17	16	13	12	11	41	13	11	12
19	11	26	13	10	16	16	19	12
17	43	51	26	17	12	17	12	10
14	12	11	73	19	12	16	12	10
17	16	11	16	41	32	17	19	17
57	16	17	22	32	41	31	26	43

12. OF THINGS BOUGHT AND SOLD BY THE TALE.

Q. Which are the denominations of things account by the Tale?

A. 12 Particulars make 1 Dozen.
12 Dozen - 1 Gross.
12 Gross or 144 Dozen 1 Great Gross.
1 Score=20
5 Score=100

QUESTIONS TO EXERCISE ADDITION.

1. A Man was born in the Year 1702, I demand wh he will be 57 years of age?

2. There are 2 numbers whose difference is 17, and th lesser Number is 44; what is the greater Number?

3. A man borrowed a Sum of Money, and paid in Pa 12l. 10s and the Remainder is 17l. 10s. I demand th Sum borrowed?

4. A owes me three Guineas, B 50l. 12s. C 140l. three score and seventeen Pounds? How much is due me in all?

5. A. B. and C. bought a parcel of Goods, in th purchase of which A laid out 3l. B 40s. and C 20d. Ho *much was laid* out in all?

6. A man hath 6 bags of Hops; the first weighs 2 qrs. 14 lb. and each of the rest weighs 14 lb. more: What quantity hath he in the whole?

7. A man took an house for 12 years; and by agreement was to pay 100 l. 10s. down: 190 l. 4s. at the end of 6 years, and 190 l. 6s. at the end of 12 years. I demand the whole Sum?

8. A Shopkeeper having opened a shop, the first week sold goods to the value of threescore pounds, the next week he took fourscore pounds, but the third week he took no more than thirty shillings. How much did he receive in all?

OF SUBTRACTION.

WHAT is the use of Subtraction?

A. By taking a less number from a greater, it shews the difference between both.

Q. How many sorts of Subtraction are there?

A. Two, Simple and Compound.

OF SIMPLE SUBTRACTION.

Q. What is Simple Subtraction?

A. Simple or Single Subtraction is the finding a difference between any two numbers, whose signification is the same as the difference between 6 yards and 4 yards is 2 yards.

Q. How are the numbers to be placed in Subtraction?

A. With units under units, tens under tens, &c. as in addition.

Q. What rule have you for the operation of Subtraction in general?

A. When the lower number is greater than the upper, take the lower number from the number which you borrow, and to that difference add the upper number, carrying one to the next lower place.

Q. What number must you borrow when the lower number is greater?

A. The same which you stop at in addition.

Q. How do you prove Subtraction?

A. By adding the remainder and the lesser line together which will always be equal to the greater line. Or, by subtracting the remainder from the greater line, and that difference will always be equal to the lesser line.

EXAMPLES.

	L.	*Yards.*	*Miles.*	*Days.*	*Months.*
From	763	7694	41372	761214	7613471
Take	122	1867	13976	121812	2813126
Diff.					

	Hours.	*lb.*	*Crowns.*	*Shillings.*
From	31261812	312617127	71161871	7612641
Take	19879428	173121712	26571014	5910917
Diff.				

OF COMPOUND SUBTRACTION.

Q. What is Compound Subtraction?

A. Compound Subtraction produces a difference between any two sums of divers denominations.

1. OF MONEY.

EXAMPLES.

	L.	*s.*	*d.*	*L.*	*s.*	*d.*	*L.*	*s.*	*d.*	*L.*	*s.*	*d.*
From	14	10	$6\frac{1}{2}$	36	12	6_{7}	76	12	$6\frac{3}{4}$	31	18	$4\frac{1}{4}$
Take	3	17	$8\frac{1}{2}$	17	12	$2\frac{1}{4}$	27	13	$3\frac{1}{4}$	16	19	1
Diff.												

	L.	*s.*	*d.*	*L.*	*s.*	*d.*	*L.*	*s.*	*d.*	*L.*	*s.*	*d.*
Borr.	41	15	3	76	3	$4\frac{1}{2}$	73	7	6	17	12	$1\frac{1}{2}$
Paid	19	17	$1\frac{1}{2}$	13	17	7	19	4	$1\frac{1}{2}$	14	7	2
Unpd.												

	L.	*s.*	*d.*	*L.*	*s.*	*d.*	*L.*	*s.*	*d.*	*L.*	*s.*	*d.*
Lent	137	11	$6\frac{1}{4}$	47	17	6	413	11	$7\frac{3}{4}$	71	18	9
Rec.	79	12	$7\frac{3}{4}$	29	11	$6\frac{1}{2}$	171	18	$9\frac{1}{2}$	17	16	$10\frac{3}{4}$
Due												

	L.	*s.*	*d.*		*L.*	*s.*	*d.*
Borrowed	764	0	0	Lent	800	10	7
	13	1	$1\frac{1}{2}$		12	11	$2\frac{1}{4}$
	17	4	2		19	12	6
	16	1	$6\frac{3}{4}$		17	11	$2\frac{1}{2}$
Paid at several times.	21	2	1	Received at several times.	14	11	3
	19	11	10		19	12	2
	26	13	$5\frac{1}{4}$		14	11	$8\frac{3}{4}$
	11	19	$6\frac{1}{2}$		17	16	$2\frac{1}{4}$
	13	12	$2\frac{3}{4}$		46	12	$7\frac{3}{4}$
Paid in all				Received in all			
Unpaid				Remains due			

2. OF TROY-WEIGHT.

	Oz. dwt. gr.	*oz. dwt. gr.*	*oz. dwt. gr.*	*lb. oz. dwt. gr.*
From	71 11 12	71 12 18	13 16 12	84 4 11 12
Take	2 10 19	10 4 19	5 19 14	17 10 11 17
Diff.				

3. OF AVOIRDUPOIS-WEIGHT.

	C. qrs. lb.	*lb. oz. dr.*	*lb. oz. dr.*	*T. C. qr. lb.*
Bou.	72 1 18	17 2 1	17 10 1	12 1 2 10
Sold	3 1 26	10 13 2	15 14 3	5 3 1 19
Unsold				

4. OF APOTHECARIES-WEIGHT.

	℥ ʒ ℈ gr.	℥ ʒ ℈ gr.	lb. ℥ ʒ ℈ gr.
From	65 4 2 10	47 5 1 16	48 2 2 0 19
Take	7 7 2 12	2 1 2 18	10 1 2 2 17
Diff.			

5. OF LONG-MEASURE.

	Le.	*m.*	*f.*	*ft.*	*Yd.*	*f.*	*in.*	*bc.*	*Le.*	*m.*	*f.*	*ft.*
From	71	1	3	10	48	0	3	2	61	0	1	3
Take	14	2	5	16	13	0	1	1	19	1	2	20
Diff.												

6 OF CLOTH-MEASURE.

	Yds.	*qr.*	*n.*	*EF.*	*qr.*	*na.*
Bot.	71	3	1	51	2	2
Sold.	14	2	3	16	1	3
Unsold						

	Yds.	*qr.*	*n.*	*EF.*	*q.*	*n.*
From	47	2	1	17	2	2
Take	12	1	3	14	4	3
Diff.						

	Yds.	*qr.*	*na.*
A Draper bought	148	0	0
Sold at several times.	14	1	2
	17	3	3
	19	1	2
	16	2	1
	17	3	3
Sold in all			
Unsold			

7. OF LAND-MEASURE.

	A.	*r.*	*p.*	*A.*	*r.*	*p.*	*A.*	*r.*	*p.*	*A.*	*r.*	*p.*
Bought	12	1	10	17	3	17	28	1	7	32	0	9
Tilled	5	3	17	12	3	23	19	1	28	16	2	23
Untilled												

8. OF WINE-MEASURE.

	T.	*hds.*	*gal.*	*T.*	*hds.*	*gal.*	*Gals.*	*qts.*	*pts.*	*Gals.*	*qts.*	*pts.*
From	3	2	10	7	2	10	19	2	1	67	1	1
Take	1	3	16	1	2	28	12	1	1	12	3	0
Diff.												

9. OF WINCHESTER-MEASURE.

	Hhds.gals.qts.	*A.B.f.gal.*	*B.B f.gal.*	*Hhds.gal.qts.*
Bou.	17 10 1	17 2 1	48 1 3	41 2 2
Sold	12 11 2	14 1 3	17 1 7	23 3 3

10. OF DRY-MEASURE.

	Ch. bu. pt.	*Ch. bu. pt.*	*Qrs. bu. pt.*	*Qrs. bu. pt.*
From	17 2 1	40 2	19 1 1	26 1 3
Take	10 1 3	16 5 1	12 7 2	19 2 2

11. OF TIME.

	D. h. m. sec.	*W. d. h. m. sec.*	*W. d. h. m. sec.*
From	41 13 22 12	14 1 10 12 10	17 1 10 12 10
Take	22 16 33 31	10 3 19 48 26	10 2 14 6 15

12. OF MOTION.

	° ′ ″	° ′ ″	° ′ ″
From	48 10 12	47 2 10	62 13 9
Take	19 11 12	12 19 46	49 18 33

QUESTIONS TO EXERCISE SUBTRACTION.

1. A man was born in the year 1702; I demand his age in the year 1781?

2. There are two numbers, the greater number is 61, and the lesser number is 44; I demand the difference?

3. There are two numbers, whose difference is 17, and the greater number 61, I demand the lesser sum?

4. The brewer and the baker drew bills each upon the other; the brewer stands indebted 45*l* 19*s* and the baker 26*l* and 7d $\frac{1}{2}$ who is the proper person indebted, and how much?

5. A man borrowed 30*l* and paid in part 12*l* 10s; I demand how much remains unpaid?

6 King Charles the martyr was beheaded in the year 1648; how many years is it since?

7. A is indebted to the brewer the sum 109*l* 10s B owes him 94*l* 4s. 10d $\frac{1}{2}$, how much does one owe more than the other?

8. What sum is that, which taken from 100*l* leaves 48*l* 17s 6d $\frac{1}{2}$?

9. There were 4 bags of money, containing as follows, viz. the first bag 34*l* the second bag 50*l* the third bag 100*l* and the fourth bag 150*l* which were to be paid to several persons? but one of the bags being lost there were but 234*l* paid; I demand which bag was wanting?

OF MULTIPLICATION.

Q. WHAT is Multiplication?

A. It is the short way of performing several additions.

Q. How many parts are there in multiplication?

A. Three viz.

1. The multiplicand, or sum to be multiplied.
2. The multiplier, or sum multiplied by.
3. The product, or total of the multiplicand, as often as there are units in the multiplier.

Note, The multiplicand and the multiplier, are also called factors, and the product the fact or rectangle.

Q. How many sorts of multiplication are there?

A. Two viz. simple and compound.

OF SIMPLE MULTIPLICATION.

Q. What is Simple Multiplication?

A. Simple Multiplication is the multiplying of any two numbers together, without respect to their signification; as 7 times 8 is 56.

Note, 1. As addition and subtraction of integers are called simple addition and simple subtraction; so should multiplication and division of integers be called simple multiplication and simple division; that only should be called compound multiplication and compound division, which hath numbers of divers denominations to be either multiplied or divided.

2. The following table must be learned perfectly by heart, *before you can proceed any* further.

THE MULTIPLICATION TABLE.

3 times	3	is 9	5 times	6	is 30	11 times	3	is 33
	4	12		7	35		4	44
	5	15		8	40		5	55
	6	18		9	45		6	66
	7	21	6 times	6	36		7	77
	8	24		7	42		8	88
	9	27		8	48		9	99
4 times	4	16		9	54	12 times	3	36
	5	20	7 times	7	49		4	48
	6	24		8	56		5	60
	7	28		9	63		6	72
	8	32	8 times	8	64		7	84
	9	36		9	72		8	96
5 times	5	25	9 times	9	81		9	108

CASE I.

Q. What do you observe in the 1st case of multiplication.

A. That the factors be placed one under another, in such manner, that units may stand under units, tens under tens, &c. and then multiply as the table directs.

EXAMPLES.

L.	*Crowns.*	*Days.*	*Hours*
47613127	47613174	71261812	71261312
2	3	4	5

Minutes.	*Yards.*	*Gallons.*	*Ounces.*
73126814	71312674	32161267	47612312
6	7	8	9

Shillings.	*Yards.*	*Bushels.*	*Ells.*
31361731	76138126	82365243	65423789
11	12	11	12

CASE 2.

Q. What do you observe in the 2d case of multiplication?

A. 1. When the multiplier consists of more figures than one, there must be made as many several products as there are figures contained in the multiplier.

2. Let the first figure of every product be placed exactly under its multiplier.

3. Add these products together, and their sum will be the total product.

Q. How do you prove multiplication?

A. Multiplication and division do mutually prove each other; yet multiplication may as truly be proved by itself, by inverting the factors.

EXAMPLES.

Crowns.	*Days.*	*Weeks.*	*Pence.*
691861	129186	281216	181281
26	98	978	763
17988368	12660228	275029248	138317403

Ounces.	*Yards.*	*Pints.*	*Quarts*
269181	261986	512617	281691
4629	7638	43859	76286
1246038849	2001049068	35640569003	21489079626

Q. What exceptions have you to this case?

A. When these figures 1 and 1, or 1 and 2, happen together in the multiplier, you may multiply by both at once as in case 1.

EXAMPLES.

Weeks.	*Bushels*	*Grains.*	*Leagues.*
761312	671612	963458	843126
412	114	912	119
313660544	76563768	878673696	100331994

2. When any other number between 12 and 20 happens, as 13, 14, 15, &c. then multiply by the figures in units place, and as you multiply, add to the product of each single figure that of the multiplicand, which stands next *on the right hand.*

EXAMPLES.

Gallons.	*Days.*	*Months.*	*lb.*
4721317	4713176	4631261	4713761
15	16	17	18

CASE 3.

Q. What do you observe in the third case of Multiplication?

A. 1. Such factors as have cyphers at the end, must be set one under another, as if there were no cyphers.

2. The cyphers placed at the end of either, or both of the factors, are to be omitted till the last product, and then the same number of cyphers must be annexed to it.

EXAMPLES.

Pence.	*Hours.*	*Years.*
476000	180120	461210
170	48100	81900
80920000	8663772000	37773099000
Nails.	*Inches.*	*Barrels.*
760000	461200	618010
4800	72000	74210
3648000000	33206400000	45862522100

CASE 4.

Q. What do you observe in the fourth case of Multiplication.

A. When cyphers are placed between the significant figures in the multiplier, they must be omitted in the operation: Regard being had to the first figure of every particular product as before.

EXAMPLES.

Gallons.	*Eggs.*	*Buttons*
128121	128128	246145
72001	70043	66012
9224841021	8974469504	14771653740

CASE 5.

Q. How do you multiply by the parts of any number instead of the whole.

A. When the multiplier is such a number, that any two figures being multiplied together, will make the said multiplier, it is shorter to multiply the given number by one of those figures, and that product by the other, as 5 times 7 is 35.

EXAMPLES.

Pounds.	*Men.*	*Soldiers.*	*Sailors.*
764126	764131	461231	461312
35	48	72	36
26744410	36678288	33208632	16607232

OF COMPOUND MULTIPLICATION.

Q. What is Compound Multiplication?

A. When several numbers of divers denominations are given to be multiplied by one common multiplier, this is called Compound Multiplication.

L. s. d.	*lb. oz. dwt. gr.*	*C. qrs. lb.*	*lb. oz. dr.*
17 3 1¼	17 5 12 16	43 1 14	17 12 10
2	3	4	5

M. f. p.	*Yds. f in. b. c.*	*Yds. qrs. n.*	*B. B. fir. gal.*
16 4 21	17 2 3 1	16 3 2	17 2 3
6	7	8	9

Ch. b. p.	*M. w. d.*	*D. h. m. sec.*	° ′
16 12 3	16 3 4	17 14 14 15	16 11 13
10	11	12	7

Note. If the learner be taught to turn back to the bills of parcels *in addition*, he will find plenty of examples in compound multiplication.

QUESTIONS TO EXERCISE MULTIPLICATION.

1. If one man's pay be 3s. what must 40 men have?
2. What is the product of 76, multiplied by 3 and by 7?
3. There are 124 men employed to finish a piece of work, and they are to have 3*l* each man; I demand how much they must all have?
4. An army of 10,000 men having plundered a city, took so much money, that when it was shared among them, each man had 27*l*. I demand how much money was taken in all?
5. There were 40 men concerned in the payment of a sum of money, and each man paid 1271*l*. how much was paid in all?
6. If one foot contains 12 inches, I demand how many inches there are in 126 feet?
7. What is the product of 769 multiplied by 9 and 7?

OF DIVISION.

Q. WHAT is Division?

A. It is a short way of performing several Subtractions, and shews how often one number is contained in another, and what remains.

Q. How many parts are there in division? A. Four, viz.

1. The dividend, or sum to be divided.
2. The divisor, or sum divided by.
3. The quotient, or answer to the question.
4. The remainder, which is always less than the divisor, and of the same name with the dividend.

Note, The divisor, dividend, and quotient are certain; but the remainder is uncertain, because some operations in division have no remainder.

Q. How many sorts of division are there?

A. Two: Simple and Compound.

OF SIMPLE DIVISION.

Q. What is Simple Division?

A. Simple Division is, when the divisor and dividend are made choice of, without any regard to their signification; as 56 divided by 7 gives 8 for the quotient; or, the number 7 is contained in 56 eight times.

Q. How many sorts of Simple Division are there?

A. Two; short division and long division.

OF REDUCTION.

Q. WHAT is Reduction?

A. Reduction is the bringing or reducing Numbers of one Denomination into other Numbers of another Denomination, but of the same value.

Q. How are Denominations of any kind reduced from one to another?

A. By Multiplication and Division.

Q. When is Multiplication to be used?

A. When great Names are to be brought into small; as Pounds into Shillings, or Days into Hours, and this is called Reduction Descending.

Q. When is Division to be used?

A. When small Names are to be brought into great: as Shillings into Pounds, or Hours into Days, and this is called [though improperly] Reduction Ascending.

Note. Whether you multiply or divide, it must be by as many of the less, as make one of the greater Denomination.

Q. How are questions in Reduction proved?

A. By varying the order of them.

1. OF MONEY.

REDUCTION DESCENDING.

1. In 46*l.* how many Shillings and Pence? Answ. 920s. 11040d.

46*l.*
20 4

920*s.*
12

11040*d.*

2. In 7*l.* how many Shillings and Pence? Answ. 140s. 1680d.

3. In 9*l.* how many Shillings, Pence and Farthings? Answ. 180s. 2160d. 8640qrs.

4. In 7*l.* 14*s.* 6*d.* ¼ how many Farthings? Answ. 7417 *qrs.*

5. Reduce 46*l.* 14*s.* 9*d.* ¾ into *qrs.* Facit 44871 *qrs.*

6. Reduce 50*l.* 9*s.* 9*d.* ½ into Half pence. Facit 24235 Half-pence.

7. Reduce 160*l.* 15s. 6*d.* into Six-pences. Facit 6431 *Six-pences.*

8. Reduce 48*l*. 12*s*. 8*d*. into groats. Facit 2918 groats.

9. Reduce 90*l* 17*s*. 6*d*. into Two-pences. Facit 9[illegible] Two-pences.

10. In 12 Crowns how many Shillings and Pence? Answ. 60*s*. 720*d*.

11. In 15*l* how many Crowns and Shillings? Answ. 60 Cr. 300*s*.

12. In 50 Half-Crowns, how many Pence and Farthings? Answ. 1500*d*. 6000 *qrs*.

13. In 306 Crowns how many Half-Crowns and Pence? Answ. 612 Half-Cr. 18360*d*.

14 Reduce 120 Six-pences into Three-pences, Pence and Farthings. Facit 240 Three-pences, [illegible]80 qrs.

15. Reduce 210 Crowns into Shillings [illegible] and Pence. Facit 1050*s*. 3,150 Groats 12600*d*

16. Reduce 86 Pounds into Crowns, Shillings and Groats. Facit 344 Cr. 1720*s* 5160 groats.

17. How many Shillings and Pence are in 7 Guineas? Answ. 357*s* 4284*d*.

18. How many Crowns and Six-pence in 28 Pounds? Answ. 112 Crowns, 1120 Six-

REDUCTION ASCENI

1. In 11040*d*. how many Shillings and [illegible]? Answ. 920*s*. 46*l*.

2|0
12]11040[92|0[46*l*

2. In 1680*d* how many Shillings and Pounds? Ans. 140*s*. 7*l*. 9 60

3. In 1840 qrs. how many Pence, Shillings and Pound Ans. 2160*d* 180*s* 9*l*.

4. In 7417 qrs. how many Pounds? Ans. 7*l*. 14*s* 6d_2^1

5. Reduce 44871 qrs. into Pounds. Facit 46*l* 14*s* 9d_2^1

6. Reduce 24235 Half-pence into Pounds. Facit 50*l*. 9d_2^1

7. Reduce 6431 Six-pences into Pounds. Facit 160*l* 15*s*. 6*d*.

8. Reduce 2918 Groats into Pounds. Facit 48*l*. 12*s* 8*d*.

9 Reduce 10905 Two-pences into Pounds. Facit 90*l* 17*s* 6*d*.

10 In 720*d*. how many Shillings and Crowns? Answ. 60*s* 12 Cr.

11. In 300*s* how many Crowns and Pounds? Answ. 60 Cr. 15*l*

12. In 6000 qrs. how many Pence and Half-Crowns? Answ. 1500*d*. 50 Half-Crowns.

13. In 18360*d* how many Half-Crowns and Crowns? Answ. 612 Half Cr. 306 Cr.

14. Reduce 2880 qrs into Pence, Three-pences, and Six-pences. Facit 720*d*. 240 Three-pences, 120 Six-pences.

15. Reduce 12600*d*. into Groats, Shillings and Crowns. Facit 3150 Groats 1050*s* 210 Cr.

16. Reduce 5160 Groats, into Shillings, Crowns and Pounds Facit 1720*s* 344 Cr. 86*l*.

17. How many Shillings and Guineas are in 4284 Pence? Answ. 357*s* 17 Guineas.

18. How many Crowns and Pounds are in 1120 Six-pences? Answ. 112 Cr. 28*l*.

REDUCTION ASCENDING AND DESCENDING.

1. In 720 Shillings, how many Pence and Crowns? Answ. 8640*d*. 144 Crowns.

720*s*.
12
5)8640(144 Crowns.

2. In [illegible] Shillings, how many Crowns and Half-[illegible] 24 Crowns, 48 Half-Crowns.

[illegible] Crowns, how many Shillings and Pounds? Ans.

[illegible] In 612 Half-Crowns, how many Crowns and Pence? Answ. 306 Crowns, 18360*d*

5. In 40 Guineas, how many Shillings, Crowns and Pounds? Answ 840*s*. 168 Cr. 42*l*

6. Reduce 12600 Pence into Shillings, Groats and Crowns. Facit 1050*s* 3150 Gr. 210 Cr.

7. Reduce 63 Crowns into Shillings and Guineas. Facit 315*s* 15 Guineas.

8. Reduce 70 Moidores into Pounds Facit 94*l*. 10*s*.

9. Reduce 12180 Three-pences into Shillings, Pence and Groats. Facit 3045*s*. 36540*d* 9135 Gr.

10. How many Crowns, Groats and Pounds, are in 1720*s*.? Answ. 344 Cr. 5160 Gr. 86*l*.

11. How many Groats, Three-pences and Six-pences, are in 121 Shillings? Answ. 363 Gr. 484 Three pences, 242 Six-pences.

12. How many Pounds and Crowns are in 1120 Six-pences.? Answ 28*l* 112 Cr

13. *How many* Crowns, Half-Crowns, and Shillings

are in 280*l.* and the number of each equal? Answ. 658, and 7*s* over.

14. Four men brought each 17*l.* 10*s.* value in gold into the mint to be coined into guineas, how many must they have? Answ 66 guineas, 14*s.*

15. There are 12 purses with each 12 guineas, how much sterling is the sum? Answ. 151*l.* 4*s.*

16. A certain ground tenant was behind with his Landlord for 16 years rent at 5*l.* 10*s.* a year, how much was the debt. Answ. 88*l.*

17. There are 34*l.* 17*s.* to be divided among 17 men, how much is it a piece? Answ. 2*l.* 1s.

18. In 19 moidores, how many pounds sterling? Ans. 25*l.* 13*s.*

OF TROY-WEIGHT.

1. 47*lb.* 10*oz.* how how many grains? Ans. 275520gr.

2 In 47128 grains of gold how many lb.? Answ. 8*lb.* 2*oz.* 3*dwts.* 16*gr.*

3. In 10*lb.* of silver, how many spoons, each 5*oz.* 10 *dwts*? Ahsw 21 spoons, and 90 *dwts.* over.

4. In 4560 Grains of gold, how many tea spoons each half an ounce? Answ. 19 tea spoons.

5 In 47 salvers each 20*oz.* how many lb? Answer 78 *lb.* 4*oz.*

6. How many porringers, each 11*oz.* are in 19*lb.* 10*oz.* 11 *dwts* of silver? Ans. 21 porringers, & 151 *dwts.* over.

7. A goldsmith having three ingots of silver, each weighing 27*oz.* was minded to make them into spoons of 2*oz.* cups of 5*oz.* salts of 1*oz.* and snuff-boxes of 2*oz.* and to have an equal number of each; the question is, what was that number; Ans. 8 of each sort & 1*oz.* over.

8 In 17 ingots of silver, each 27*oz.* 10*dwts.* how many grains? Answ. 224400*gr.*

OF AVOIRDUPOIS-WEIGHT.

Q. Which are the allowances usually made dupois great weight to the buyer?

A. They are tare, trett, and cloff.

Q. What is tare?

A. Tare is an allowance made to the buye weight of the box, bag, vessel, or whatever els the goods bought; and is either,

1. At so much per bag, barrel, box, &c.
2. At so much per cent. or
3. At so much in the gross weight, calle

Q. What is trett?

A. Trett is an allowance made by the merchant to the buyer of 4*lb* in 104*lb*. that is, the six and twentieth part for waste and dust, in some sorts of goods.

Note. If an allowance be made both for tare and trett, in the same parcel of goods, the tare is first to be deducted, and that remainder is called Suttle weight.

Q. What is cloff?

A. Cloff is an allowance of 2*lb*. weight to the citizens of London, on every draft above 3C weight, on some sorts of goods, as galls, madder, sumac, argol, &c.

Q. What are these allowances, called beyond the seas?

A. They are called the courtesies of London; because they are not practised in any other place.

Q. What is Gross Weight?

A. Gross is the weight of any sort of merchandize, and that which contains it, being weighed both together.

Q. What is Neat Weight.

A Neat is the pure weight of goods, after all allowances are deducted.

Note 1. Raw, Long, Short, China, Morea silk, &c. are weighed by a great pound of 24 ounces. But Ferret Filosella, Sleeve-silk, &c. by the common pound of 16 ounces.

2. To bring great pounds into common, multiply dy 3, and divide by 2.

3. To bring common pounds into great, multiply by 2, and divide by 3.

Case 1.

Examples.

1. In 7*C*. 3*qrs*. 10*lb*. how many *oz*. and *drams*. Answ. 14048*oz*. 224768*dr*.

2. In 3 tons of iron, how many *C*. *qrs*. and *lb*. Answ. 3 *C*. 240 *qrs* 6720*lb*.

14048*oz*. How many *C*. Answ. 7*C*. 3*qrs*. 10*lb*.

6720*lb* of iron, how many tons? Answ. 3 tons.

451 great pounds of Morea silk, how many *oz*. and Answ 11064*oz*. 177024 *dr*.

40426 drams of silk, how many great pounds? 105 great pounds, 6*oz*. 10*dr*.

3*lb* of Cinnamon, how many parcels, each 12*oz*. parcels.

parcels of sugar, each 26*lb*. how many *C*. 0*qrs*. 12 *lb*.

9. In 672 great Pounds of Silk, how many common Pounds? Answer 1008 common *lb.*

10. In 480 common Pounds of Silk, how many great Pounds? Answer 320 great pounds.

11. In 8 Hogsheads of Tobacco, each weighing neat 7 C. $\frac{1}{2}$ how many Pounds? Answ. 6720 *lb.*

12. In 17 Pigs of Lead, each weighing 4 C. $\frac{3}{4}$ how many Fother, at 19 C. $\frac{1}{2}$? Answ. 4 Fother, 2 C. 3*qrs.*

13. In 712 C. of Lead, how many Fother? Answ. 36 Fother, 10 C.

14. In 17 C. 1*qr.* 6*lb.* of Sugar, how many parcels, each 17 *lb.*? Answer 114 Parcels.

Case 2.

OF TARE AND TRETT, &c.

Note, If the Teacher approves of it he may introduce this and the following Cases after Practice, instead of this Place.

Q. When the Tare is at so much per Barrel, Bags, &c. how is the Neat Weight found?

A. Multiply the Number of the said Barrels, Bag, &c. by the Tare and substract that Product from the Gross; the Remainder is the Neat.

Note 1. The Table of Allowance for Tare in the Book of Rates, says;

For Cyprus *and* Smyrna *Silk.*

Bales	*about or above* 300 *lb,*	*The Tare per Bale, is,*	16
	from 300 *to* 200		14
	from 200 *downwards*		12

For Virginia *Tobacco.*

Hhds.	5 C. *and upwards*	*The Tare per Hhd. is,*	100
	from 5 *to* 4 C.		90
	from 4 *to* 3 C.		80
	under 3 C.		70

Sugar from India.

In Casks and Canisters	*Tare*	$\frac{1}{6}$
In Chests and Casks from St. Thorme,		$\frac{1}{5}$

Oil from Candia

Tare 29*lb. per Barrel.*

2. 7*lb.* $\frac{1}{2}$ *of oil make a Gallon; therefore to reduce Pounds into Gallons multiply by* 2, *and divide by* 15.

Examples.

1. In 16 Hogsheads of Tobacco each 5. C 1*qr* 19*lb.* Gross, Tare per Hogshead, 100 *lb* how much Neat Weight? Answ. 72 C. 1 *qr* 20*lb.*

		C.	qr.	lb.
		5	1	19
				4 by the Parts.
		21	2	20
16				4
100				
4	C. qr. lb.			
28]1600[57[14	1 4 Gross	86	2	24
	Tare	14	1	4
	Neat	72	1	20

2. In 70 Bales of Smyrna Silk, each 317 *lb.* Gross, Tare per Bale 16 *lb* how many *lb.* Neat? Ans. 21070*lb.*

3. In 14 Hogsheads of Tobacco, weighing Gross 89 C. 3 *qrs* 17 *lb* Tare per Hogshead 100 *lb* how much Neat Weight? Answ. 77 C. 1 *qr.* 17 *lb.*

4. What is the Neat Weight of 30 Bales of Cyprus Silk each weighing 249*lb.* Gross, Tare per Bale 14*lb* ? Answ. 7050 *lb.*

Case 3.

Q. When the Tare is at so much per Cent, how is the Neat Weight found?

A. When the Tare is an aliquot Part or Parts of the C. Weight, divide the whole Gross by the said Part or Parts, that the Tare is of an C. Weight, and the quotient hence arising, gives the Tare of the Whole; which subtract from the whole Gross, the Remainder is Neat.

Note 1. Figs, Almonds, Argol, &c. 14lb.
Caroteels, Butts of Currants, &c. 16 } percent
Oil in uncertain Casks &c. 18

2. Whatever Part the given Tare is of an C. Weight, the same must the whole Tare be of the given Gross Weight.

Examples.

What is the Neat Weight of 12 Barrels of Argol, Gross 48 *C.* 3 *qrs.* 12*lb* Tare 14*lb.* per cent? Answ. 42 *C* 3 *qrs.*

	C.	qrs.	lb.	
14=$\frac{1}{7}$	48	3	12	Gross.
	6	0	12	Tare
	42	3	0	Neat

2. In 12 Butts of Currants, each 7 C. 1 *qr.* 10 *lb.* Gross, Tare per Cent 16 *lb.* how much neat Weight? Answ. 75 *C. 1 qr. 26lb. 14 oz.*

3. What is the neat weight of 30 barrels of figs, each 2C. 3 *qrs.* gross, tare per cent. 14*lb.*? Answ. 72C. 21*lb.*

Note. When the tare is not the aliquot part or parts of an C. weight, then multiply the pounds gross, by the tare per cent given, and that product divide by 112, the quotient is the whole tare, which subtract from the gross, the remainder is neat.

4. What is the neat produce of 20 barrels of anchovies, each gross 33lb. tare per cent. 10lb? Answ. 601 lb. 2 *oz.*

5. What is the neat produce of 17 barrels of Potash, each gross 223 *lb.* tare 10*lb.* per cent.? Ans. 3142*lb.* 19 *oz.*

CASE 4.

Q. When the tare is at so much in the whole gross weight, how is the neat weight found?

A. Subtract the tare from the gross, and the remainder is neat.

EXAMPLES.

1. What is the neat weight of 33 hogsheads of Tobacco, weighing gross 201 C. 3 *qrs.* 12*lb.* tare in the whole 3140*lb?* Answ. 175C. 3*qrs.* 8*lb.*

2. What is the neat weight of 3 hogsheads of Tobacco, weighing as follows, viz.

	C.	qrs.	lb.		lb.
No 1—	3	1	2	Tare	80
2—	3	2	1		80
3—	5	1	12		100? Ans. 9C. 3qrs. 7lb.

CASE 5.

Q. How is the neat weight found, when trett is allowed with tare?

A. Divide the pounds Suttle by 26, the quotient is the trett, which subtract from the Suttle the remainder is neat.

EXAMPLES.

1. In 8 C. 3qrs. 20 lb. gross, tare 38 lb. trett 4 lb. per 104 lb. how many pounds neat? Answ. 925 lb. neat wt.

2. In 177 C. 0 qrs. 22lb. gross, tare 9 lb per cent, trett 4 lb per 104 lb. how many C. weight neat? Ans. 156 C. 2 qrs. 22lb.

3. In 17 chests of Sugar weighing 120 C. 2 qrs. gross, tare 176 lb. trett 4 lb. per 104 lb. how many C. weight neat? Answ. 114 C. 1 qr. 12*lb.*

Note. There are other allowances, not so common, such as break, which is at so much per barrel, bag, &c. and damage, which is so much in the whole, but they are very easy.

3. OF APOTHECARIES WEIGHT.

1. In 12lb. 1 ℥ 2 ℥. 0 ℈. 1 gr. how many grains? Ans. 69721 grains.

2. In 69721 Grains how many ℈. ʒ. ℥. and lb. Ans. 12lb. 1 ℥. 2ʒ. 0℈. 1 gr.

OF LONG-MEASURE.

1. In 70 miles, how many furlongs, and poles? Ans. 560 furlongs, 22400 poles.

2. In 40 yards how many feet, inches and barley-corns? Answ. 120 feet, 1440 inches, 4320 barley-corns.

3. In 5 miles, how many barley-corns Ans. 950400 barley-corns.

4. In 4000 inches, how many yards? Ans. 111 yds. 4 in.

5. In 4 leagues, how many yards? Answ. 21120 yds.

6. In 15840 yards, how many miles and leagues? Ans. 9 miles, 3 leagues.

7. How many barley-corns in a mile? Answ. 190080 barley-corns.

8. How many times doth the wheel, which is 18 feet 6 inches round, turn between London and York, which is 150 miles? Ans. 42810 times, and 180 inches over.

9. How many barley-corns will reach round the globe of the earth, which is 360 degrees, and each degree 69 miles and a half? Ans. 4755801600 barley-corns.

OF CLOTH-MEASURE.

1. In 14 yards, how many quarters and nails: Ans. 56 qr. 224 nails.

2. In 17 yds. 1 qr. 2 na. how many nails? Ans. 278 na.

3. In 4712 nails, how many yds? Ans. 294 yds. 2 qrs.

4. In 47128 nails of Irish cloth, how many pieces, each 12 yards? Ans 245 pieces, 5 yards, 2 quarters.

5. In 4 pieces of cloth, each 14 yards, how many quarters and nails? Ans. 224 qrs. 896 na.

6. In 10 bales of cloth each 10 pieces each 12 yards, how many yards? Ans. 1200 yards.

7. In 7000 nails of Holland how many ells? Ans. 350 ells.

8. Reduce 42 ells into quarters and nails. Facit 210 qrs 840 nails.

OF LAND-MEASURE.

1. In 40 acres, how many roods and perches? Ans. 160 roods, 6400 perches.

2. In 17 A. 3r. 12 p. how many perches? Ans. 285 2p.

3. Reduce 2852 perches into acres. Facit 17 A. 3r. 12 p.

4. If a piece of ground contains 24 acres and an inclosure of 17 acres 3 roods be taken out of it, how many *perches are there* in the remainder? Ans. 1000 perches.

5. One field contains 7 acres, another 10 acres, and a third 12 acres 1 rood, how many shares of 76 perches each are contained in the whole? Answ. 61 shares, and 44 perches over.

OF LIQUID-MEASURE.

1. In 17 Gallons how many quarts and pints; Answ. 68 qts. 136 pints.

2 In 10 Barrels of beer, how many gallons and quarts? Answ. 360 gals. 1440 qts.

3. In 4 barrels of ale, how many gals? Ans. 128 gals.

4. In 72 Hogsheads of Beer, how many Barrels? Ans. 108 Barrels.

5. In 91 barrels of beer, how many hogsheads? Ans. 60 hhds. 36 gals.

6. If a Back contains 30 Barrels of Beer, how many gallons doth it hold? Ans. 1080 gals.

7. In 4 tons of Oil, how many hogsheads, gallons and quarts? Ans. 16 hhds. 1008 gals. 4032 quarts.

8. In 3 hogsheads of Brandy how many half anchors? Ans. 37 half anchors, 4 gals.

9. In 1712 gallons of Wine, how many hogsheads? Ans. 27 hhds. 11 gals.

10. If a Vintner be desirous to draw off a pipe of Canary into bottles, containing pints, quarts, and 2 quarts, and of each an equal number, how many must he have? Ans. 144 of each sort.

OF DRY-MEASURE.

1. In 40 quarters of Wheat, how many bushels and pecks? Ans. 320 bushels, 1280 pecks.

2. Reduce 1280 pecks of Wheat, into quarters. Facit 40 qrs.

3. In 30 chaldron of Coals, each 36 bushels, how many pecks? Ans. 4320 pecks.

4. Reduce 7094 pecks of Coals into chaldrons. Facit 40 chal. 9 bush. 2 pecks.

OF TIME.

1. In 121812 seconds how many hours? Answ 33 hrs. 50 min. 12 sec.

2. Reduce 41 weeks, into days, hours and minutes. Facit 287 days, 6888 hours, 413280 minutes.

3. Reduce 413280 minutes into weeks. Facit 41 wks.

4. How many seconds in a year, allowing it to be, 365 days, 6 hours? Ans. 31557600 seconds.

5. How many days have passed since the birth of Christ to Christmas 1781? Ans. 650510 days 6 hours.

6. From March 2 to November 19 following, (inclusive) how many days? Ans. 263 days.

OF MOTION.

In half a years time the Sun makes his progress thro' 6 Signs of the Zodiac, how many degress minutes and seconds doth that amount to? Ans. 180 degrees, 10800 minutes, 648000 sec.

OF THE SINGLE RULE OF THREE.

Q. HOW many Parts are there in the Rule of Three.

A. Two: Single or Simple & Double or compound.

Q. By what is the Single Rule of Three known?

A. By Three Terms, which are always given in the question to find a fourth.

Q. Are any of the Terms given to be reduced from one Denomination to another?

A. If any of the given Terms be of several Denominations, they must be reduced into the lowest Denomination mentioned.

Q. What do you observe concerning the 1st & 3d Terms?

A. They must be of the same name and kind.

Q. What do you observe concerning the 4th Term?

A. It must be of the same name and kind with the 2d.

Q. What do you observe of the three given Terms taken together?

A. That the 2 first are a supposition, the last is a demand.

Q. How is the third Term known?

A. It is known by these, or the like words, What cost? How many? How much?

Q. How many sorts of Proportion are there?

A. Two: Direct and Inverse.

1. *OF DIRECT PROPORTION.*

Q. What is Direct Proportion?

A. Direct Proportion is when more requires more, or less requires less.

Q. What do you mean by more requires more?

A. More requires more is when the third term is greater than the first; and therefore requires the fourth term to be greater than the second in the same proportion.

Q. What do you mean by less requires less?

A. *Less* requires less is when the third term is less

than the first; and therefore requires the fourth term to be less than the second in the like proportion.

Q. How is the fourth term in Direct Proportion found?

A. By multiplying the second and third terms together, and dividing that product by the first term.

Q. What Proportion doth the fourth number bear to any other?

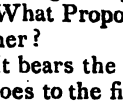
A. It bears the same Proportion to the second, as the third does to the first.

Q. How do you prove questions in the Rule of Three Direct?

A. By changing their order.

EXAMPLES.

1. If 3 oz. of Silver cost 17s. what will 48 oz. cost? Answer 13*l.* 12s.



Oz. *s.* *oz.*
3 : 17 : 48
17
——
2|0 *l.* *s.*
3]816[27|2[13 12

2. If 8lb. of ginger cost 3s what cost 26lb. Ans. 1*l.* 6s.

3. If 2 oz. of Silk cost 2s 6d what cost 7lb. Ans. 7*l.*

4. If one gallon of ale cost 8d. what cost 36 gallons? Answer 1*l.* 4s.

5. If 1 lb. of sugar cost 4d$\frac{1}{2}$, what cost 48lb.? Ans. 18s.

6. If 1 lb. of sugar cost 4d what cost 1 C.? Ans. 1*l* 17*s* 4*d*.

7. If an C. of sugar cost 2*l.* 12*s*. what cost 1 lb.? Ans. 5d. 2qrs. $\frac{32}{112}$.

8. If 1 gallon of beer cost 4d. what cost a barrel? A. 12s.

9. If 1 pair of Stockings cost 2s. 3d. what cost 19 dozen pair? Answer 25*l.* 13s.

10. If 19 dozen pair of shoes cost 25*l.* 13s. what cost 1 pair? Answer 2s. 3d.

11. Bought a firkin of butter, containing 56 lb. for 18s. 8d. what is that per lb. Answer 4d.

12. Sold 3 C. weight of Tobacco, at 18d. per lb. what is the price of the whole? Ans. 25*l.* 4s.

13. Bought 19 chaldrons of Coals, at 29s. 6d. per chaldron, what come they to? Answer 28*l.* 0s. 6d.

14. If 1 lb. of Sugar cost 9d. what cost 17 C. 2 qrs.? Answer 73*l.* 10s.

15. If 1 oz of Silver cost 5s. 6d. what is the price of a tankard that weighs 1 lb. 10 oz. 10 dwts. 4 gr.? Answer 6*l.* 3s. 9d. 2 qrs. $\frac{96}{480}$.

16. If 1 lb. of Tobacco cost 15d. what cost 3 hhds. weighing together 15 C. 1qr. 19 lb. Ans. 107*l.* 18s. 9d.

17. If a yard of cloth is worth 14s. what is the worth of 5 pieces, each 19 yards? Ans. 66*l.* 10s.

18. If an ell of Holland cost 4s. 6d. what is the value of 5 pieces, each 12 ells? Ans. 13*l.* 10s.

19. If a bushel of Coals cost 10d. how many chaldrons for 100*l.* Ans. 66 ch. 24 bush.

20. How many quarters of corn for 40 guineas, at 4s. per bushel? Ans. 26 qrs. 2 bush.

21. If a man's yearly income be 300*l.* what is it per day? Ans. 16s. 5d. 1 qr. $\frac{15}{365}$.

22. If a man spend 7 pence per day, how much is that in a year? Ans. 10*l.* 12s. 11d.

23. If a pint of Wine cost 10d. what cost 3 hhds.? Ans. 63*l.*

24. If a pipe of Canary cost 40*l.* how much is that per pint? Ans. 9d. 2 qrs. $\frac{96}{1008}$.

25. Bought 12 pieces of Cloth, each 12 yards, at 10s. 6d. per yard, what come they to? Ans. 75*l.* 12s.

26. What cost 120 yards of Cloth, at 3s. per yard? Answer 18*l.*

27. A merchant bought 4 pieces of Holland, each 12 ells, for 7*l.* 10s. what did 1 ell cost? Ans. 3s. 1d. $\frac{1}{2}$.

28. A Grocer bought 3 hhds of Sugar, each 10 C. 3 qrs. 12 lb Gross, Tare 26 lb. per hhd. at 2d. $\frac{1}{2}$ per lb. I demand what the 3 hhds. came to? Ans. 37*l.* 3s. 9d.

29. How much must I pay for the carriage of 10 C. $\frac{1}{2}$ at the rate of 1d. $\frac{1}{2}$ per lb.? Ans. 7*l.* 7s.

30. If 6 Horses eat up 21 bushels of oats in a week's time, how many bushels will serve 20 Horses the same time? Ans 70 bushels.

31. If a family of 10 persons spend 3 bushels of Malt in a month, how many bushels will serve them, when they are 30 in family? Ans. 9 bushels.

32. If an Ingot of Silver weighs 36 oz. 10 dwt. what is it worth at 5s. per oz.? Ans. 9*l* 2s. 6*d*.

33. How many yards of Lace for 100*l.* at 3s. 6d. per yard? Ans. 571 yards $\frac{8}{42}$.

34. If a merchant hath owing to him 1000*l.* and his debtor doth agree to pay him for every pound 12s. 6d. I demand how much he must pay in all? Ans 625*l.*

35. A Goldsmith sold a Tankard for 10*l.* 12s. at the rate *of 5s 4d. per oz,* I demand the weight of it? Ans. 39 oz. *15 dwts.*

36. A man bought a piece of cloth for 16*l.* 10s. per yard, how many yards did it contain ? Ans. 22 ›

37. If 1C. weight of cheese cost 37s. 4d. what is t. per lb ? Ans. 4d.

38. Coals at 33s. per chaldron, how much per bushel ? Ans. 11d.

39. What cost 49392 case knives, at 4s. 4d. per dozen ? Ans. 891*l.* 16s.

40. If a gentleman has an estate of 245*l.* 10s. a year how much may he spend one day with another to lay up 60 guineas at the years end ? Ans. 10s. per day.

41. If 17C. 3qrs. 17lb. of tobacco cost 133*l.* 13s 4d what cost 1oz ? Ans 1d.

42. If 1 C. weight of lead cost 15s. 11d. what cost 5 fother ? Answ. 77*l.* 11s. 10d. $\frac{1}{2}$.

43. If a ton of wine cost 42l. what cost 1 qrt. Ans. 10d.

44. At a noble per week, how many months board may I have for 50l. Ans. 37 months 2 weeks,

45. What cost a pack of wool, weighing 2 C. 1 qr. 19lb. at 8s. 6d. per Stone ? Ans 8l. 4s. 6d. 1qr $\frac{10}{14}$.

46. What is cheese per C. weight, at 3d. $\frac{1}{2}$ per lb. Ans. 1 *l.* 12s. 8d.

47. If a yard of cambrick cost 12s. What cost 4 pieces, each 20 yards ? Ans. 48*l.*

48. If a yard of broad cloth cost 18s. What cost 5 pieces, each 20 yards ? Ans. 90*l.*

49. If Lead be sold for a 1d. $\frac{1}{2}$ per lb. what is 3 C Weight worth ? Ans. 2*l.* 2s.

50. If coffee be sold for 8d $\frac{1}{4}$ per oz. What is 6 C Weight worth? Ans. 369*l.* 12s.

2. OF INVERSE PROPORTION.

Q. What is Inverse Proportion ?

A. Inverse Proportion is when more requires less, or less requires more.

Q. What is meant by more requires less ?

A. More requires less, is when the third term is greater than the first and requires the fourth term to be less than the second.

Q. What is meant by less requires more ?

A. Less requires more, is when the third term is less than the first, and requires the fourth term to be greater than the second.

Q. How is the fourth Term in Inverse Proportion found?

A. By multiplying the first and second Terms together, and dividing that product by the third Term.

Q. What Proportion does the fourth term bear to any of the rest?

A. It bears such proportion to the second as the first does to the third.

EXAMPLES.

1. If 48 men can build a wall in 24 days, how many men can do the same in 192 days? Ans. 6 men.

2. If I lent my Friend 100*l* for 6 months, (allowing the month to be 30 days) how long ought he to lend me 1000*l* to requite my kindness? Ans. 18 days.

3. If 100*l* in 12 months gain 6*l* interest what principal will gain the same in 8 months? Ans. 150*l*.

4. If a footman performs a journey in 3 days when the days are 16 hours long, how many days will he require of 12 hours long to go the same journey in? Ans. 4 days.

5. How many yards of Matting that is half a yard wide, will cover a room that is 18 feet wide, and 30 feet long? Ans. 120 yards.

6. If 28s will pay for the carriage of an C. weight 150 miles, how far may 6 C. weight be carried for the same money? Ans 25 miles.

7. How much in length that is 3 inches broad, will make a foot square? Ans 48 inches.

8. If 15 Shillings worth of Wine will serve 46 men, when the tun is worth 12*l* how many men will the same 15 Shillings worth suffice, when the tun is worth but 8*l*? Ans. 69 men.

9. If when the price of a bushel of Wheat is 6s 3d the penny-loaf will weigh 9 oz what must the penny-loaf weigh, when Wheat is at 4s. 6d. per bushel? Answer 12 oz. 10 dwts.

10. Suppose 800 Soldiers were placed in a garrison, and their provisions were computed sufficient for two months; how many Soldiers must depart, that the provisions may serve them 5 months? Ans. 480 men.

11. There is a Cistern, having a cock, which will empty it in 12 hours; I demand how many cocks of the same capacity there must be to empty it in a quarter of an hour? Ans. 48 cocks.

12. *There* was a certain building raised in 8 months by 120 workmen but the same being demolished, it is

required to be rebuilt in 2 months, I demand how many men must be employed about it? Answer 480 men.

OF PRACTICE.

Q. WHAT is Practice?

A. It is a short way of finding the value of any quantity of Goods by the given price of one Integer.

Q. How do you prove questions in Practice?

A. By the Single Rule of Three Direct: Or, Practice may be proved by itself, by varying the parts.

THE TABLES.

s.	*d.*
$\frac{1}{2}$ is	6
$\frac{1}{3}$	4
$\frac{1}{4}$	3
$\frac{1}{6}$	2
$\frac{1}{8}$	$1\frac{1}{2}$
$\frac{1}{12}$	1

l.	*s.*	*d.*
$\frac{1}{2}$ is	10	0
$\frac{1}{3}$	6	8
$\frac{1}{4}$	5	0
$\frac{1}{5}$	4	0
$\frac{1}{6}$	3	4
$\frac{1}{8}$	2	6
$\frac{1}{10}$	2	0
$\frac{1}{12}$	1	8

l.	*s.*	*d.*
$\frac{1}{15}$	1	4
$\frac{1}{16}$	1	3
$\frac{1}{20}$	1	0
$\frac{1}{30}$	0	8
$\frac{1}{40}$	0	6
$\frac{1}{60}$	0	4
$\frac{1}{80}$	0	3
$\frac{1}{120}$	0	2

Cwt.	*lb.*
$\frac{1}{2}$ is	56
$\frac{1}{4}$	28
$\frac{1}{7}$	16
$\frac{1}{8}$	14
$\frac{1}{14}$	8
$\frac{1}{28}$	4

CASE 1.

Q. What must be done with the Price of an Integer, when it is less than a Penny?

A. Find the aliquot Parts of that Price contained in a Penny, which must be Divisors to the given Sum; that is, if the Price be a Farthing, say a Farthing is the Fourth of a Penny, and set it thus, $\frac{1}{4}|\frac{1}{4}|$. If the price be a half-penny, then say a half-penny is the half, thus $\frac{1}{2}|\frac{1}{2}|$. If it be three farthings, then say, a half-penny is the half of a penny, & a farthing is the fourth of a penny, thus $\left|\begin{array}{c|c}\frac{1}{2} & \frac{1}{2} \\ \frac{1}{4} & \frac{1}{4}\end{array}\right|$

Q. What do you observe concerning these columns?

A. The first column contains the Money, and the other the parts.

Note 1. When there are more aliquot parts than one, their quotients must be added together and the sum, if the first aliquot part be taken from a penny, will be pence; if it be taken from a shilling, will be shillings, or if it be taken from a pounds will be pounds.

2. It is frequently better to take part of parts than parts of the whole price; and then the three farthings above mentioned may as well be taken thus. $\left|\begin{array}{c|c}\frac{1}{2} & \frac{1}{2} \\ \frac{1}{4} & \frac{1}{2}\end{array}\right|$ that is, a half penny is the $\frac{1}{2}$ of a penny, and a farthing is the half of a half-penny.

EXAMPLES.

1

$\frac{1}{4}$ | $\frac{1}{4}$ | 7 6 1 2 at $\frac{1}{4}$

2 | 1 9 0 3

2|0 | 1 5 | 8 7

7*l* 18*s* 7*d*

2

$\frac{1}{2}$ | $\frac{1}{2}$ | 6 8 1 2 at $\frac{1}{2}$

2 | 3 4 0 6

2|0 | 2 8 | 3 10

14*l* 3*s* 10*d*

3

$\frac{1}{2}$ | $\frac{1}{2}$ | 4 7 1 2 at $\frac{3}{4}$

$\frac{1}{4}$ | $\frac{1}{2}$ | 2 3 5 6
1 1 7 8

2 | 3 5 3 4

2|0 | 2 9 | 4 6

1 4*l* 14*s* 6*d*

4

1280 at $\frac{1}{4}$

Facit 1*l* 6*s* 8*d*

5

7672 at $\frac{1}{2}$

Facit 15*l* 19*s* 8*d*

6

9180 at $\frac{3}{4}$

Facit 28*l* 13*s* 9*d*.

CASE 2.

Q. What must be done with the Price of an Integer, when it is less than a Shilling?

A. Find the aliquot part of that price contained in a shilling which must be divisors to the given sum. Or thus,

If the given price be not the aliquot part of a Shilling, then first take some part of it that is an aliquot part: and for the remaining part of the price, let it be taken out of the foregoing part or parts, and then add the quotient together as before; the total will be the answer in Shillings.

EXAMPLES.

1

$\frac{1}{12}$ | 7 6 1 2 at 1d

2 0 | 6 3 | 4

3 1*l* 14*s* 4*d*

2

1 | $\frac{1}{12}$ | 8 6 1 2 at 1d $\frac{1}{4}$

$\frac{1}{4}$ | $\frac{1}{4}$ | 7 1 7 8
1 7 9 5

2|0 | 8 9 | 7 1

4 4*l* 17*s* 1*d*

No. 3.
6812 at 1d

Facit 28*l* 7*s* 8*d*
4
1861 at 1d $\frac{1}{4}$

Facit 9*l* 13*s* 10*d* $\frac{1}{4}$
5
4121 at 1d $\frac{1}{2}$

Facit 25*l* 15*s* 1*d* $\frac{1}{2}$
6
1861 at 1d $\frac{3}{4}$

Facit 13*l* 11*s* 4*d* $\frac{3}{4}$
7
6181 at 2d $\frac{1}{4}$

Facit 57*l* 18*s* 11*d* $\frac{1}{4}$
8
1218 at 2d $\frac{1}{2}$

Facit 12*l* 13*s* 9*d*
9
8012 at 2d $\frac{3}{4}$

Facit 91*l* 16*s* 1*d*
10
7612 at 3d

Facit 95*l* 3*s*
11
6128 at 3d $\frac{1}{4}$

Facit 82*l* 19*s* 8*d*
12
6180 at 3d $\frac{1}{2}$

Facit 90*l* 2*s* 6*d*
13
7812 at 3d $\frac{3}{4}$

Facit 122*l* 1*s* 3*d*

No. 14.
8120 at 4d

Facit 135*l* 6*s* 8*d*
15
7000 at 4d $\frac{1}{4}$

Facit 123*l* 19*s* 2*d*
16
6801 at 4d $\frac{1}{2}$

Facit 112*l* 10*s* 4*d* $\frac{1}{2}$
17
7121 at 4d $\frac{3}{4}$

Facit 140*l* 18*s* 8*d* $\frac{3}{4}$
18
7181 at 5d

Facit 149*l* 12*s* 1*d*
19
8121 at 5d $\frac{1}{4}$

Facit 177*l* 12*s* 11*d* $\frac{1}{4}$
20
6128 at 5d $\frac{1}{2}$

Facit 140*l* 8*s* 8*d*
21
6100 at 5d $\frac{3}{4}$

Facit 146*l* 2*s* 11*d*
22
1000 at 6d

Facit 25*l*
23
7610 at 6d $\frac{1}{4}$

Facit 198*l* 3*s* 6*d* $\frac{1}{2}$
24
1218 at 6d $\frac{1}{2}$

Facit 32*l* 19*s* 9*d*

No. 25	No. 36
6000 at 6d $\frac{3}{4}$	6100 at 9d $\frac{1}{2}$
Facit 168*l* 15*s*	Facit 241*l* 9*s* 2d
26	37
7101 at 7d	5918 at 9d $\frac{3}{4}$
Facit 207*l* 2*s* 3*d*	Facit 240*l* 8*s* 4d $\frac{1}{2}$
27	38
1001 at 7d $\frac{1}{4}$	8121 at 10d*
Facit 30*l* 4*s* 9*d* $\frac{1}{4}$	Facit 338*l* 7*s* 6d
29	39
4100 at 7d $\frac{1}{2}$	6712 at10d $\frac{1}{4}$
Facit 128*l* 2*s* 6*d*	Facit 286*l* 13*s* 2d
29	40
6120 at 7d $\frac{3}{4}$	1002 at 10d $\frac{1}{2}$
Facit 197*l* 12*s* 6*d*	Facit 43*l* 16*s* 9d
30	51
7100 at 8d	4680 at 10d $\frac{3}{4}$
Facit 236*l* 13*s* 4*d*	Facit 209*l* 12*s* 6d
31	42
6100 at 8d $\frac{1}{4}$	1260 at 11d
Facit 209*l* 13*s* 9*d*	Facit 57*l* 15*s*
32	43
8000 at 8d $\frac{1}{2}$	6121 at 11d $\frac{1}{4}$
Facit 283*l* 6*s* 8*d*	Facit 286*l* 18*s* 5d $\frac{1}{4}$
33	44
6000 at 8d $\frac{3}{4}$	1234 at 11d $\frac{1}{2}$
Facit 218*l* 15*s*	Facit 59*l* 2*s* 7d
34	45
9000 at 9d	2345 at 11d $\frac{3}{4}$
Facit 837*l* 10*s*	Facit 114*l* 16*s* 1d $\frac{3}{4}$
35	46
4121 at 9d $\frac{1}{4}$	100 at 11d $\frac{3}{4}$
Facit 158*l* 16*s* 7*d* $\frac{1}{4}$	Facit 4*l* 17*s* 11d

*Note, when the Price of an Integer is 10d. annex a cypher to the given Numbe and divide by 12 and by 20.

Case 3.

Q. What must be done with the price of an integer, when it is greater than a shilling, but less than two shillings?

A. Let the part or parts be taken only with so much of the given price as is more than one shilling; that is, if the price be 14d $\frac{3}{4}$, take the parts only with 2d$\frac{1}{2}$ and let the given quantity stand for shillings, which must be added with the rest; and the total will be the answer in shillings.

Examples.

No. 1.

$\frac{1}{4}$ | 4 8 6 at 12d. $\frac{1}{4}$

$\frac{1}{4}$ | 1 2 1 $\frac{1}{2}$

12 | 1 0 1 $\frac{1}{2}$

4 9 | 6 1 $\frac{1}{2}$

20 |

2 4*l* 16*s* 1 $\frac{1}{2}$

2

4 8 6 at 12d $\frac{1}{2}$

$\frac{1}{2}$ $\frac{1}{2}$ |

2 4 3

2 |

2 0 3

5 0 | 6 3

0 |

2 5*l* 6*s*. 3d

3

7612 at 12d $\frac{1}{4}$

Facit 388*l* 10*s* 7d

4

1216 at 12d $\frac{1}{2}$

Facit 63*l* 6*s* 8d

5

1216 at 12d $\frac{3}{4}$

Facit 64*l* 12*s*.

No. 6.

6121 at 13d

Facit 331*l* 11*s* 1d

7

1281 at 13d $\frac{1}{4}$

Facit 70*l* 14*s* 5d $\frac{1}{4}$

8

6100 at 13d $\frac{1}{2}$

Facit 343*l* 2*s* 6d

9

1210 at 13d $\frac{3}{4}$

Facit 69*l* 6*s* 5d $\frac{1}{2}$

10

1210 at 14d

Facit 70*l* 11*s* 8d

11

1271 at 14d $\frac{1}{4}$

Facit 75*l* 9*s* 3d $\frac{3}{4}$

12

6120 at 14d $\frac{1}{2}$

Facit 369*l* 15*s*

13

1210 at 14d $\frac{3}{4}$

Facit 74*l* 7*s* 3d $\frac{1}{2}$

14

1260 at 15d

Facit 78*l* 15*s*

No. 15
1612 at 15d $\frac{1}{4}$

Facit 102*l* 8*s* 7d
16
1210 at 15d $\frac{1}{2}$

Facit 78*l* 2*s* 11d
17
7612 at 15d $\frac{3}{4}$

Facit 499*l* 10*s* 9d
18
6100 at 16d

Facit 406*l* 13*s* 4d
19
7121 at 16d $\frac{1}{4}$

Facit 482*l* 3*s* 0d $\frac{1}{4}$
20
1218 at 16d $\frac{1}{2}$

Facit 83*l* 14*s* 9d
21
8100 at 16d $\frac{3}{4}$

Facit 565*l* 6*s* 3d
22
4128 at 17d

Facit 292*l* 8*s*
23
1230 at 17d $\frac{1}{4}$

Facit 88*l* 8*s* 1d $\frac{1}{2}$
24
2340 at 17d $\frac{1}{2}$

Facit 170*l* 12*s* 6d
25
3450 at 17d $\frac{3}{4}$

Facit 255*l* 3*s* 1d $\frac{1}{2}$

No. 26
4560 at 18d

Facit 342*l*
27
5670 at 18d $\frac{1}{2}$

Facit 431*l* 3*s* 1d $\frac{1}{2}$
28
6789 at 18d $\frac{1}{2}$

Facit 523*l* 6*s* 4d $\frac{3}{4}$
29
7890 at 18 $\frac{3}{4}$

Facit 616*l* 8*s* 1d $\frac{1}{4}$
30
8900 at 19d

Facit 704*l* 11*s* 8d
31
9000 at 19 $\frac{1}{4}$

Facit 721*l* 17*s* 6d
32
9876 at 19d $\frac{1}{4}$

Facit 802*l* 8*s* 6d
33
8765 at 19d $\frac{3}{4}$

Facit 721*l* 5*s* 8d $\frac{3}{4}$
34
7120 at 20d $\frac{1}{4}$

Facit 600*l* 15*s*
35
6543 at 20d $\frac{1}{2}$

Facit 558*l* 17 7d $\frac{1}{2}$
36
5432 at 20d $\frac{3}{4}$

Facit 469*l* 12*s* 10d

No. 37	No. 43
4321 at 21d	6700 at 22d $\frac{1}{2}$
Facit 378*l* 1*s* 9d	Facit 628*l* 2*s* 6d
38	44
3210 at 21d $\frac{1}{4}$	6812 at 22 $\frac{3}{4}$
Facit 284*l* 4*s* 4d $\frac{1}{2}$	Facit 645*l* 14*s* 5d
39	45
2100 at 21d $\frac{1}{2}$	1210 at 23d
Facit 188*l* 2*s* 6d	Facit 115*l* 19*s* 2d
40	46
1000 at 21d $\frac{3}{4}$	1800 at 23d $\frac{1}{4}$
Facit 90*l* 12*s* 6d	Facit 174*l* 7*s* 6d
41	47
1090 at 22d*	6760 at 23d $\frac{1}{2}$
Facit 99*l* 18*s* 4d	Facit 661*l* 18*s* 4d
42	48
9010 at 22d $\frac{1}{4}$	9990 at 23d $\frac{3}{4}$
Facit 835*l* 6*s* 0d $\frac{1}{2}$	Facit 988*l* 11*s* 10d $\frac{1}{2}$

* Note When the price of an integer is 22d. annex a cypher to the given number, and divide by 12 (as at 10d) then add both lines together; the sum will be the total in shillings.

Case 4

Q. What must be done with the Price of an Integer, when it is any even number of Shillings under 20*s*. as 6*s*. 8*s*. &c.

A. Multiply the given quantity by half of the price, and double the first figure of the product for Shillings, and the rest of the product will be pounds.

Note. *This Rule is taken from an Operation in Decimals.*

Examples.

No. 1	No. 3
486 at 2*s*	7612 at 2*s*
1	
48*l* 12*s*	Facit 761*l* 4*s*
2	4
769 at 4*s*	1286 at 4*s*
2	
153*l* 16*s*	Facit 2571 4*s*

No 5	No 8
7618 at 6*s*	171 at 14*s*
Facit 2285*l* 8*s*	Facit 119*l* 14*s*
6	9
191 at 8*s*	171 at 16*s*
Facit 76*l* 8*s*	Facit 136*l* 16*s*
7	10
180 at 10*s**	712 at 18*s*
Facit 90*l*	Facit 640*l* 16*s*

* Note. When the price of an Integer is 10*s*. you may take half of the given Integers, and it is done; and the Remainder (if there be any) will be 10*s*.

Case 5.

Q. What must be done with the Price of an Integer, when it is any odd Number of Shillings under 20*s*. as 3*s* 5*s*. &c.

A. Multiply the given Integers by the Prices, and that product divide by 20, and the quotient will be the answer.

Examples.

No. 1	No. 6
121 at 1*s*	121 at 11*s*
Facit 6*l* 1*s*	Facit 66*l* 11*s*
2	7
121 at 3*s*	600 at 13*s*
Facit 18*l* 3*s*	Facit 390*l*
3	8
471 at 5*s**	190 at 15*s*
Facit 117*l* 15*s*	Facit 142*l* 10*s*
4	9
860 at 7*s*.	121 at 17*s*
Facit 301*l*	Facit 102*l* 17*s*
5	10
612 at 9*s*	100 at 19*s*.
Facit 275*l* 8*s*	Facit 95*l*

* Note. When the Price of an Integer is 5*s*. the Work may be done at once; because 5*s*. *is the fourth* part of a pound.

Case 6.

Q. What must be done with the Price of an Integer, when it is Shillings and Pence?

A. 1. If the Shillings and Pence be the aliquot part of a Pound, it may be done at once, as 6s. 8d. is the third of a Pound.

Examples.

No. 1

12 at 6*s* 8*d*

Facit 4*l*

2

69 at 3*s* 4*d*

Facit 11*l* 10*s*

No. 3

21 at 2*s* 6*d*

Facit 2*l* 12*s* 6*d*

4

96 at 1*s* 8*d*

Facit 8*l*

2. If the Shillings and Pence be not the aliquot part of a Pound, or if there be Shillings, Pence and Farthings, multiply the given quantity by the Shillings, and take parts with the rest, and add them together: the Sum will be the answer in Shillings.

Examples.

No. 1

3 | $\frac{1}{4}$ | 1 2 6 at 9*s* 3*d*

9

1 1 3 4

3 1 6

2 | 0 | 1 1 6 | 5 6

58*l* 5*s* 6*d*

2

86 at 6*s* 10*d*

Facit 29*l* 7*s* 8*d*

3

10 at 11*s* 4*d*

Facit 6*l* 3*s* 4*d*

4

30 at 4*s* 9*d*

Facit 7*l* 2*s* 6*d*

No. 5

73 at 7*s* 6*d*

Facit 27*l* 7*s* 6*d*

6

70 at 7*s* 4*d* $\frac{3}{4}$

Facit 25*l* 17*s* 8*d* $\frac{1}{2}$

7

55 at 4*s* 8*d* $\frac{1}{2}$

Facit 12*l* 18*s* 11*d* $\frac{1}{2}$

8

77 at 10*s* 6*d* $\frac{1}{4}$

Facit 40*l* 10*s* 1*d* $\frac{1}{4}$

9

12 at 13*s* 10*d* $\frac{1}{2}$

Facit 8*l* 6*s* 6*d*

10

17 at 17*s* 4*d* $\frac{1}{4}$

Facit 14*l* 15*s* 0*d* $\frac{1}{4}$

Case 7.

Q. What must be done with the price of an Integer, when it is pounds only?

A. Multiply the given integers by the price, the product will be the Answer.

Examples.

No. 1.	No. 3.
72 at 5*l*	19 at 4*l*
Facit 360*l*	Facit 76*l*
2	4
64 at 3*l*	46 at 7*l*
Facit 192*l*	Facit 322*l*

Case 8.

Q. What must be done with the price of an Integer, when it is pounds and shillings?

A. Multiply the integers, given, by the pounds; then proceed with the shillings, if they are even, according to case 4; but if they are odd, according to case 5, and add them together; the total will be the Answer.

Examples.

No. 1.	No. 4.
26 at 4*l* 8*s*	48 at 7*l* 10*s*
4	
104	Facit 360*l*
10 8	5
114*l* 8*s*	26 at 11*l* 14*s*
2	Facit 304*l* 4*s*
49 at 3*l* 7*s*	6
7	15 at 4*l* 13*s*
2|0 34|3	Facit 69*l* 15*s*
17 8	7
147	17 at 9*l* 15*s*
164*l* 3*s*	Facit 165*l* 15*s*
3	8
36 at 5*l* 13*s*	16 at 3*l* 6*s*
Facit 203*l* 8*s*	Facit 52*l* 16*s*

Case 9.

Q. What must be done with the price of an Integer, when it is pounds, shillings, and pence?

A. 1. If the Shillings and Pence be the aliquot part of a Pound, multiply the given Integers by the Pounds, and divide by the aliquot Part: Those numbers, so found out, being added together, will be the sum required.

Examples:

No. 1.

47 at 3*l* 3*s* 4*d*

Facit 148*l* 16*s* 8*d*

2

20 at 4*l* 13*s* 4*d*

Facit 93*l* 6*s* 8*d*

No. 3.

17 at 21*l* 6*s* 8*d*

Facit 39*l* 13*s* 4*d*

4

30 at 1*l* 2*s* 6*d*

Facit 33*l* 15*s*

2. If the Shillings and pence be not the aliquot part of a Pound, or if there be shillings, pence and farthings, given with the pounds, then reduce the pounds and shillings into shillings, and multiply the given Integers by the said shillings; next take parts with the rest of the Price, and add them together as before.

Examples.

No. 5.

120 at 4*l*. 7s. 3d. $\frac{1}{2}$

87 20

10440 87

3 | $\frac{1}{4}$ | 30

$\frac{1}{2}$ | $\frac{1}{6}$ | 5

2 | 0 | 1047 15

523*l*. 15*s*.

14 at 2 *l*. 10. 6d.

Facit 35 *l*. 7*s*.

No. 6.

21 at 5*l*. 14s. 7d. $\frac{1}{4}$

Facit 120 *l*. 6s. 8d. $\frac{1}{4}$

7

70 at 1*l*. 14s. 7d.

Facit 121*l*. 0s. 10d.

8

46 at 3*l*. 19s. 8d. $\frac{1}{2}$

Facit 183*l*. 6s. 7d.

Q. What other way have you of answering Questions in this case?

A. 1. When the number of Integers does not exceed 12, multiply the Price by the Integers, as in Compound Multiplication, the Product will be the Answer.

2. When the number of Integers does exceed 12, multiply that Price by the Parts instead of the whole. Or,

3. You may multiply the Price by the whole Number of Integers. Thus,

58361 Hhds. of Tobacco, at 48*l.* 12*s.* 9*d.* per Hhd.

l.	*s.*	*d.*
48	12	9
	58361	

48	12	9
2918	5	0
14591	5	0
389100	0	0
2431875	0	0
2838533	2	9

Memorandum.

1.	2.	3.	4
s. *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
16 6			
18 3	2 6		
2 0			
3 9	17 6	15	10 0

Q. How is it wrought?

A. Multiply by the several figures in the Multiplier, as in Compound Multiplication, but with this difference, that the product of the Shillings and Pence multiplied by the 6, 3, 8, and 5, must be placed by themselves in a Memorandum, and the product of the Pounds by the same figures, placed as in Simple Multiplication. Thus,

l.	*s.*	*d.*
48	12	9
	58361	

				Memor.	
1 *Product* - - - - -	48	12	9		
2 - - - - - - - - - -	291			16	6
3 - - - - - - - - - -	145			18	3
4 - - - - - - - - - -	389			2	0
5 - - - - - - - - - -	243			3	9

Then to fill up the blanks in the second product, take half of the 16*s.* in the memorandum, which is 8*s.* and set it in the units place of the pounds. Annex a Cypher to the 6*d.* which makes 60*d.* or 5*s.* place this under the Shillings, and the line is done with, there being no pence remaining.

For the blanks in the third product, take half of the 18*s.* in the memorandum, and put it in the tens place of the pounds. Annex a Cypher to the 3d. which makes it 30*d.* or 2*s.* 6*d.* this put in the second memorandum. Then take half of the 2*s.* in this new memorandum, and put in the units place of the pounds. Annex a Cypher to the 6*d* in the new memorandum, which makes 60*d.* or 5*s.* put this in the place of shillings, and this line is finished, there being no pence remaining.

For the blanks in the fourth product, take half of the 2*s*. in the first memorandum, and put it in the hundreds place of the pounds; and because there remains nothing, nor are there any pence in the memorandum, therefore fill up the other blanks with cyphers, and the line is finished.

For the blanks in the fifth product, take half of the 3s. in the first memorandum, and put it in the thousands place of the pounds; then, because there is one remaining, put that in the second memorandum. Annex a cypher to the 9*d*. which makes 90d. or 7*s*. 6*d*. put this to the former 1, and it makes 17*s*. 6*d*. take half of the 17*s*. and put it in the hundreds place of the pounds: then because there is one remaining, put that in the third memorandum. Annex a cypher to the 6*d*. and it makes 60*d*. or 5*s*. put this to the 1 in the third memorandum, and it makes 15*s*. take half the 15*s*. and put it in the tens place of the pounds; then, because there remains 1, put it in the fourth memorandum, and since there are no pence in the third memorandum to put a cypher to, let a cypher be annexed to the 1 in the last memorandum which makes 10*s*. take half of this 10*s*. and put it in the units place of the pounds: then, because there are no pence in the memorandum, neither is there any thing remaining of the 10, therefore fill up the other blanks with cyphers, and the line is completed: add all together, and their sum is the total product of the whole.

2. *L. s. d.* *Memorandum.*

7000 hhds. of wine at 17 14 8 per hhd.	l.	2	3.
7000	s. d.	s. d.	s. d.
	2 8	6 8	6 8
124133 6 8			

Note 1. To fill up the blanks in the pounds of the second, third, &c. products, always take half the shillings in the memorandum; and if 1 remains, make a new memorandum of it.

2. Always annex a cypher to the pence, and whatever number of shillings they make, put them to the 1 in the new memorandum; and so on till all the blanks in the pounds are filled up: if there be any pence yet remaining in the memorandum, put a cypher to them, and what shillings and pence they make, let them be put in the shillings and pence place in the product.

3. All the examples in this case, and case, 8, may serve here, instead of others.

Case 10.

Q. What must be done with the price of an Integer when both that and the quantity given are of several Denominations?

A. multiply the price by the integers, and take parts with the parts of the integers.

EXAMPLES.

NO.	C. qrs. lb.			L. s.	L. s. d.
1.	12 3 16	of tobacco.	at 4 12 per C. wt.	Facit 59 6 $1\frac{1}{2}$+	

$\frac{1}{2}$	$\frac{1}{2}$	12	
		55	4
$\frac{1}{4}$	$\frac{1}{2}$	2	6
16	$\frac{1}{7}$	1	3
		0	13 $1\frac{1}{2}$+
		59	6 $1\frac{1}{2}$+

NO.	C. qrs. lb.			L. s. d.	L. s. d.
2.	12 2 14	of tobacco,	at 3 14 0 per C.	Facit 46 14 3	
3.	17 3 19	of sugar,	at 2 2 6 per C.	Facit 38 1 $6\frac{3}{4}$	
4.	4 1 16	of soap,	at 3 12 0 per C.	Facit 15 16 $3\frac{3}{4}$	
5.	10 0 12	of tallow,	at 1 19 6 per C.	Facit 19 19 $2\frac{1}{4}$	
6.	5 1 0	of tobacco,	at 2 17 0 per C.	Facit 14 19 3	
7.	4 3 0	of sugar,	at 2 18 6 per C.	Facit 13 17 $10\frac{1}{2}$	
8.	7 0 19	of sugar,	at 3 16 0 per C.	Facit 27 4 $10\frac{1}{4}$	
9.	5 2 10	of tobacco,	at 2 18 $6\frac{1}{2}$ per C.	Facit 16 7 $2\frac{1}{4}$	
10.	7 1 14	of tobacco,	at 3 15 $9\frac{1}{4}$ per C.	Facit 27 18 $9\frac{1}{2}$	
11.	9 2 26	of tallow,	at 4 10 $4\frac{1}{2}$ per C.	Facit 43 19 6	

OF INTEREST.

Q. HOW many kinds of Interest are there?

A. Two: Simple and Compound.

OF SIMPLE INTEREST.

Q. What is Simple Interest?

A. Simple Interest is the profit allowed in the lending or forbearance of any sum of money, for some determined space of time.

Q. What is the principal?

A. The principal is any sum of money lent, for which interest is to be received.

Q. What is the rate per cent.

A. It is a certain sum agreed on between the lender and the borrower, to be paid for every 100*l* for the use of the principal, which according to the laws of England, ought not to be above 5*l*. for the use of 100*l*. for 1 year, and 10*l*. for the use of 100*l*. for 2 years; and so on for *any sum of money*, in proportion to the time proposed.

Q. What is the amount?

A. It is the Principal and Interest added together.

Q. What other things is Interest applicable to?

A. It is applied to Commission or Provision, Brokage, Storage, and Insurance, which have no respect to time.

CASE 1.

Q. How do you find the interest of any given sum for a year?

A. Multiply the principal by the rate per cent, and divide that product by 100, the quotient is the interest required.

Q How do you find the interest of any given sum for several years?

A. Multiply the interest for one year by the number of years given in the question; the product will be the answ.

EXAMPLES.

1. If 100*l* in one year's time yied 5*l* interest, what will 486*l* yield in the same time? Ans. 24*l* 6*s*.

$$\begin{array}{r|l} 486l & \\ 5 & \\ \hline 24 & 30 \\ & 20 \\ \hline 6 & 00 \end{array}$$

2. What is the interest of 220*l* for a year, at 4 per cent. per ann.? Answ. 8*l* 16*s*.

3. What is the interest of 76*l* for two years, at 5 per cent. per ann? Answ 7*l* 12*s*.

4. What is the amount of 400*l* for 12 years, at 6 per cent. per ann.? Ans. 688*l*.

Of Factors Allowances, commonly called Commission or Provision.

Q. What is Commission or Provision?

A. It is an Allowance from Merchants to their Factors or Agents beyond the Seas, in the buying or selling of any sort of Goods: and is a certain rate per cent. according to the Custom of the Country where the Factor resides.

EXAMPLES.

5. My Factor sends me word, that he has bought Goods to the value of *L* 500 13*s* 6d upon my account; I demand what his Commission comes to, at $3\frac{1}{2}$ per cent? Ans. *L* 17 10*s* 5*d* 2 qrs. $\frac{6}{100}$.

6. My correspondent has disbursed upon my account, the sum of *L* 1009 18*s* what must he demand for his Commission when I allow him 2 $\frac{1}{4}$ per cent? Ans. *L* 22 14*s* 1 qr. $\frac{49}{100}$.

7 Suppose I allow my Correspondent 1 $\frac{3}{4}$ per cent. for Provision; what may he demand on the disbursement of *L* 704 15*s* 4d? Ans. *L* 12 6*s* 8*d*. $\frac{3}{100}$.

CASE 2.

Q. How do you find the interest of any sum for $\frac{1}{4}$, $\frac{1}{2}$ or $\frac{3}{4}$ of a year, besides the number of years given in the question.

A. For $\frac{1}{4}$ of a year, take a fourth part of the interest for one year; for $\frac{1}{2}$ of a year, take half of the interest for one year; for $\frac{3}{4}$ of a year take the parts compounded of $\frac{3}{4}$ and add them to the interest for the rest of the time; the sum will be the interest required.

EXAMPLES.

1. What is the interest of *L* 200 for 3 years and $\frac{3}{4}$ at 5 per cent. per annum? Answ. *L* 37 10*s*.

200	$\frac{1}{2}$	$\frac{1}{2}$	10
5			3
10|00			30
			5
	$\frac{1}{4}$	$\frac{1}{4}$	2 10
			37 10

2. What is the interest of *L* 468 13*s* 4*d* for one year and $\frac{3}{4}$ at 6 per cent. per annum? Ans. *L* 49 4*s* 1d.

3. What is the interest of *L* 112 10*s* 4*d* for 5 years and $\frac{1}{2}$ at 6 per cent. per annum? Answ. *L* 37 2s 6*d*.+

4. What is the interest of *L* 468 for 4 years and $\frac{1}{4}$, at 6 per cent. per annum? Ans. *L* 119 6*s* 8*d* $\frac{1}{4}$.

5. What is the interest of *L* 1000 for 2 year $\frac{3}{4}$, at 4 per cent. per annum? Ans. *L* 110.

OF BROKAGE.

Q. What is Brokage?

A. It is an allowance made to persons called Brokers, at a certain rate per cent. finding customers, and selling to them the Goods of other men, whether strangers or natives.

Q. How do you find the Brokage of any sum?

A. Divide the given sum by 100, and take parts from *the quotient with* the rate per cent.

Examples.

6. What is the brokage of 700*l* 14*s* 6*d* at 4*s* per cent? Ans. 1*l* 8*s* 0*d* $\frac{1}{4}$.

L.	*s.*	*d.*			*L.*	*s.*	*d.*
7 00	14	6	4	$\frac{1}{5}$	7	0	$1\frac{1}{2}$
20							
0 14					1	8	$0\frac{1}{4}$
12							
1 74							
4							
2 96							

7. What may a broker demand for brokage, when he sells goods to the value of 500*l* 10*s* 7*d* and I allow him 7*s* per Cent? Ans. 1*l* 15*s* 0*d*$\frac{1}{4}$.

8. Suppose I employ a broker, who sells goods to the value of 909*l* 14*s* 10*d* what is the brokage at 6*s* 6*d* per cent? Ans. 2*l* 19*s* 1*d*$\frac{1}{4}$.

Note. If the brokage should be 1*l*. or more per cent. the operation will be the same with that in factors allowances.

Case 3.

Q. How is the interest of any sum found when the rate per cent is $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$, more than the pounds given in the said rate?

A. Multiply the principal by the pounds, in the rate per cent as before; and let the parts for one $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$, be taken from the principal, and added to that product; then proceed according to case 1 or 2.

Examples.

1. What is the interest of 400*l* for 2 years, at 5 $\frac{1}{2}$ per cent per annum? Answ 44*l*.

2. What is the interest of 120*l* for a year at 4 $\frac{1}{2}$ per cent per annum? Ans. 5*l* 8*s*.

3. What is the amount of 690*l* for three years, at 4 $\frac{1}{4}$ per cent per annum? Ans. 777*l* 19*s* 6*d*.

4. What is the amount of 120*l* 10*s* for two years and an half, at 4 $\frac{3}{4}$ per cent per annum? Ans. 134*l* 16*s* 1*d*$\frac{3}{4}$.

5. What is the interest of 300*l* for 5 years and 3 quarters, at 3 $\frac{3}{4}$ per cent per annum? Ans. 64*l* 18*s* 9*d*.

CASE 4.

Q. How do you find the interest of any sum, for a certain number of weeks?

A. As 52 weeks
Are to the interest of the given sum for a year:
So are the weeks given,
To the interest required.

EXAMPLES.

1. What is the interest of 400*l* for a week, at 5 per cent per annum? Ans. 7*s* 8*d* 1*qr*. $\frac{1}{52}$.

2. What is the interest of 126*l* 12*s* for 16 weeks, at 4 $\frac{1}{2}$ per cent per annum? Ans. 1*l* 15*s* 0*d* 2 *qrs*. $\frac{40}{52}$.

3. What is the amount of 500*l* for 20 weeks at 3 $\frac{1}{2}$ per cent per annum? Ans. 506*l* 14*s* 7*d* 1 *qr*. $\frac{28}{52}$.

CASE 5.

Q. How is the principal found, when the amount, time, and rate per cent are given?

A. As the amount of 100*l* at the rate and time given
Is to 100*l*.
So is the amount given,
To the principal required.

EXAMPLES.

1. What principal being put to interest for 9 years, at 5 per cent per annum, will amount to 725*l*? Ans. 500*l*.

2. What principal being put to interest for 7 years, will amount to 793*l* 12*s* at 4 per cent per annum? Ans. 620*l*.

3. What sum being put to interest will amount to 520*l* 16*s* in 8 years, at 3 per cent per annum? Ans. 420*l*.

CASE 6.

Q How is the rate per cent found when the amount, time and principal are given?

A. 1 As the principal,
Is to the interest for the whole time:
So is 100*l*.
To its interest for the same time

2. Divide the interest last found by the time, and the quotient will be the rate per cent.

EXAMPLES.

1. At what rate of interest per cent will 500*l* amount to 725*l* in 9 years time? Ans. 5 per cent.

2. At what rate of interest per cent will 620*l* amount 793*l* 12*s* in 7 years? Ans 4 per cent.

3. At what rate of interest per cent will *L* 420 amount to *L* 520 16*s* in 8 Years? Ans. 3 per Cent.

CASE 7.

Q. How is the time found when the principal, amount nad rate per cent are given?

A. As the interest of the principal for 1 year at the given rate
Is to one year:
So is the whole interest,
To the time required.

EXAMPLES.

1. In what time will *L* 500 amount to *L* 725 at 5 per cent per annum? Ans. 9 years.

2. In what time will *L* 620 amount to *L* 793 12*s* at 4 per cent per annum? Ans. 7 years.

3. In what time will *L* 420 amount to *L* 520 16*s* at 3 per cent per annum? Ans. 8 years.

Q. How are the questions in the foregoing cases proved?

A. Cases 1, 5, 6, and 7 do exactly prove each other, by varying the questions: yet all of them except case 5, and the 1st, 2d, 5th, 6th, and 7th, questions in case 1, and the 6th, 7th and 8th, in case 2, may as truly be answered by the double rule of three, of which more hereafter.

Note 1. The 1st, 2d, 5th, 6th and 7th Questions in Case 1, and the 6th 7th and 8th, in case 2, are to be proved by the single rule of three.

2. Case 5th, cannot be answered by the double rule of three, becausethe principal is not known in the question, and there can be no deduction of it from the amount, to know the interest, which must first be done.

OF SIMPLE INTEREST FOR DAYS.

Q. How do you find the interest for any number of days?

A. Multiply the pence of the principal by the days, & by the rate of interest for a dividend, and 365 by 100 for a divisor, the quotient will be the answer in pence.

Q. How are the following questions proved?

A. As 365 days
Are to the interest of a given sum for a year:
So is the time proposed.
To the interest required.

EXAMPLES.

1. What is the interest of *L* 120 for 126 days, at 4 per cent per annum? Ans. *L* 1 13*s* 1*d* 2 qr. $\frac{258}{365}$.

2. What is the interest of *L* 126 for 145 days, at 6 per cent *per annum*? Ans. *L* 3 0*s* 0*d* 2 qr. $\frac{335}{365}$.

3. What is the interest of *L* 100 from June 1, 1775, to March 9, 1776, which is Leap Year, at 5 per cent. per annum? Ans. *L* 3 17*s* 6*d* 1 qr. $\frac{235}{365}$.

4. What is the interest of *L* 200 from August 14, to December 19 following, at 6 per cent per annum? Ans. *L*4 4*s* 1*d* 3 qrs. $\frac{325}{365}$.

5. What is the interest of *L* 10 for 25 days, at 5 per cent per annum? Ans. 8*d* $\frac{80}{365}$.

6. What is the interest of *L* 40 for 40 days, at 4 per cent per annum? Ans. 3*s* 6*d* $\frac{30}{365}$.

See more of Simple Interest in decimals.

OF COMPOUND INTEREST.

Q. What is Compound Interest?

A. Compound Interest is that which arises from any principal and its interest put together, as the interest still becomes due; and for that reason it is called interest upon interest, or compound interest.

Q. Is it lawful to let out money at compound interest?

A. No: yet in purchasing of annuities or pensions, and leases in reversion, it is very usual to allow compound interest to the purchaser for his ready money; and therefore it is very necessary to understand it.

Q. How do you find the compound interest of any given sum for any number of years?

A. Find the amount of the given sum by simple interest for the first year, which is the principal for the second year then find the amount of that principal for the second year, and that is the principal for the third year; and so on for any number of years given.

2. Subtract the given sum from the last amount, and the remainder is the compound interest required.

EXAMPLES.

1. What sum will *L* 450 amount to in three years, at 5 per cent per ann. compound interest? Ans. *L* 520 18*s* 7*d* $\frac{1}{2}$.

2. What will *L* 400 amount to in 4 years, at 6 per cent per annum, compound interest? Ans. *L* 504 19*s* 9*d* $\frac{1}{4}$.

3. What will *L* 480 amount to in 6 years, at 5 per cent per annum compound interest? Ans. *L* 643 4*s* 10*d* $\frac{1}{2}$

4. What will 500*l* amount to in 4 years at $4\frac{1}{4}$ per ce per annum, compound interest? Ans. *L* 590 11*s* 5*d* $\frac{1}{4}$

5. What is the compound interest of *L* 400 10*s* at 5 *per cent* per annum, for 3 years? Ans. *L*43 10*s* 9*d* $\frac{1}{2}$

Note. See more of Compound Interest in Decimals.

OF REBATE OR DISCOUNT.

Q. WHAT is Rebate or Discount?

A. Rebate or Discount is when a sum of Money due at any time to come, is satisfied by paying so much present money, as being put out to Interest, would amount to the given sum in the same space of Time.

Q. How is the Operation performed?

A. 1. As 12 Months:
Are to the Rate per Cent.:
So is the Time proposed:
To a fourth Number.

2. Add that fourth Number to 100*l*.

2. As that Sum:
Is to the fourth number:
So is the given sum:
To the Rebate.

4. Subtract the Rebate from the given Sum, and the Remainder is the present Worth. Or thus,

3. As that Sum:
Is to 100*l*.
So is the given Sum:
To the present Payment.

4. Subtract the present Payment from the given Sum, and the remainder is the Rebate.

Q. How do you prove questions in Rebate?

A. Find the Amount of the present Payment at the Time and Rate per Cent given, and that will be equal to the given Sum.

EXAMPLES.

1. What is the Rebate of 795*l* 11*s* 2*d* for 11 Months, at 6 per cent? Ans. 41*l* 9*s* 5*d* 3 qrs. $\frac{157}{253}\frac{2}{2}$.

2. What is the present Worth of 161*l* 10*s* for 19 Months, at 5 per cent? Ans. 149*l* 13*s* 0*d* $\frac{3}{4}$.

3. Sold goods for 795*l* 11*s* 2*d* to be paid 4 months hence, what is the present worth at 3 $\frac{1}{2}$ per cent? Ans 786*l* 7*s* 8*d* $\frac{1}{4}$.

4. What is the present Worth of 4000*l* payable in 9 months, at 4 $\frac{3}{4}$ per cent? Ans. 3862*l* 8*s* 0*d* $\frac{1}{2}$.

5. How much ready money for a note of 18*l* due 15 months hence, at 5 per cent? Ans. 16*l* 18*s* 10*d*.

6. Suppose 810*l* were to be paid 3 months hence, allowing 5 per cent discount, what must be paid in hand? Ans. 800*l*.

7. If a legacy of 1000*l* is left me July 24, 1776, to be paid on the Christmas-day following; what must I receive, when I allow 6 per cent for the present payment? Ans. 975*l* 3*s*. 1*d*.

8. Being obliged by bond bearing date August 29, 1776, to pay next midsummer (which is leap year) 326*l* what must I pay down, if they allow discount after the rate of 8 per cent? Ans. 305*l* 16*s* 6*d*. $\frac{1}{4}$.

9. Sold goods for 312*l* to be paid at two three months, (that is, half at three months, and the other half at three months after that) what must, be discounted for the present payment, at 5 per cent? Ans. 5*l* 14*s* 7*d*.

10. Sold goods for 300*l* to be paid at three two months that is, one third at 2 months, one third at 4 months, and one third at 6 months) what must be discounted for present payment at 4 per cent? Answ. 3*l* 18*s*. 9*d*.

11. What is the present worth of 100*l* at 5 per cent payable at two four months? Ans. 97*l* 11*s* 4*d* $\frac{1}{2}$.

12. I would know the present worth of 150*l* payable at three four months, at 5 per cent discount? Answ. 145*l* 3*s* 9*d* $\frac{1}{4}$.

13. What is the present worth of 200*l* at 4 per cent payable as follows, viz. 100*l* at two months; 50*l* at 3 months; and 50*l* at 5 months? Ans. 198*l* 0*s* 6*d*.

OF EQUATION OF PAYMENTS.

The Common Way.

Q. WHAT is Equation of Payments?

A. When several sums of money, to be paid at different times, are reduced to one mean time for the payment of the whole, without loss to debtor or creditor, this is called equation of payments.

Q. Wherein may the debtor or creditor be said to suffer loss; when the debt is paid.

A. 1. When one mean time is assigned for the payment of the whole debt, and the money is not paid till some time afterwards: then the debtor suffers loss by laying not only out of the principal, or sum due, but also the interest of that sum for the time of forbearance, at 3, 4, or more per cent as they shall agree. Likewise, if the money be paid before it is due, then the creditor suffer loss by allowing so much per cent by agreement, for the *time of prompt* payment.

2. The Loss to either party may be in reducing the several times of payment to one, which is not the true equated time; and then if the payment be made after the true time, the creditor suffers loss, because he receives no interest for it; if the time agreed on be before the true time, then the debtor suffers loss, because he receives no interest for his early payment.

Q. How is the operation wrought?

A. Multiply each payment by its time, and divide the sum of all the products by the whole debt, the quotient is the equated time.

Examples.

1. A owes B *L* 100 whereof *L* 50 is to be paid at 2 months and *L* 50 at 4 months; but they agree to reduce them to one payment, when must the whole be paid? Answ. 3 months.

2. A merchant hath owing to him *L* 300 to be paid as follows: *L* 50 at 2 months, *L* 100 at 5 months, and the rest at 8 months: and it is agreed to make one payment of the whole; I demand when that time must be? A. 6 months.

3. F owes to H *L* 1000 whereof *L* 200 is to be paid present, *L* 400 at 5 months, and the rest at 10 months, but they agree to make one payment of the whole; I demand the equated time? Ans. 6 months.

4. K is indebted to L a certain sum, which is to be discharged at 4 several payments, that is $\frac{1}{4}$ at 2 months, $\frac{1}{4}$ at 4 months, $\frac{1}{4}$ at 6 months, and $\frac{1}{4}$ at 8 months; but they agreeing to make but one payment of the whole, the equated time is therefore demanded? Ans. 5 months.

5. H bought of X a quantity of Goods upon Trust, for which H was to pay $\frac{1}{3}$ of the debt every 3 months, till the whole should be discharged; but they afterwards agreed to pay the whole at one equated time, the time is demanded? Ans. 6 months.

6. W owes Z a sum of money which is to be paid $\frac{1}{2}$ present, $\frac{1}{4}$ at 4 months, and the rest at 8 months, what is the equated time for the whole? Ans. 3 months.

7. P. owes Q. *L* 420 which will be due 6 months hence; but P is willing to pay him *L* 60 now provided he can have the rest forborn, a longer time: It is agreed on; the time of forbearance therefore is required? Ans. 7 months.

Note. This Question is in Reverse Proportion. See more of this Rule in Decimals.

OF BARTER.

Q. WHAT is Barter?

A. Barter is the Exchanging of one Commodity for another, and informs Merchants so to proportion their quantities, as that neither may sustain loss.

Q. How do you prove Questions in Barter?

A. By changing the order of them.

EXAMPLES.

1. How much Sugar at 9*d* per *lb.* must be given in Barter for 6 C. $\frac{1}{2}$ of Tobacco, at 14*d* per *lb.*? Ans. 10 C 0qr. 12 *lb.* $\frac{4}{5}$.

2. What quantity of Tea, 10*s.* per *lb.* must be given in Barter for 1 C. of Chocolate at 4*s* per *lb.*? Answ. 44 *lb.* 12 oz. $\frac{8}{10}$.

3. How much Rice at 28*s* per C. must be bartered for 3 C. $\frac{1}{2}$ of Raisins, at 5*d* per *lb.*? Ans. 5 C. 3 qrs. 9*lb.* $\frac{112}{336}$.

4. A and B bartered; A had 5 C. of Sugar at 6*d* per *lb.* which he gave to B for a quantity of Cinnamon, at 10*s* 8*d* per *lb.* I demand how much Cinnamon B gave A? Ans. 26 *lb.* 4 oz.

5. B delivered 3 hhds. of Brandy, at 6*s* 8*d* per gallon, to C for 126 yards of Cloth: What was the Cloth per yard? Answ. 10*s.*

6. A and B bartered: A had 12 C. of Sugar worth 4*d* per *lb.* for which B gave him 1 C. $\frac{3}{4}$ of Cinnamon; I demand how B rated his Cinnamon per *lb.*? Ans. 27*d* 1 qr. $\frac{140}{196}$.

7. A hath Linen Cloth worth 20*d* an ell ready money; but in barter he will have 2*s.* B hath Broad Cloth worth 14*s* 6*d.* per yard ready money at what price ought the Broad Cloth to be rated in Barter? Answ. 17*s* 4*d* 3 qrs. $\frac{4}{20}$ per yard.

8. A and B bartered: A had 41 Cwt. of Hops, at 30*s* per C. for which B gave him 20*l.* in money, and the rest in Prunes, at 5*d* per *lb.* I demand how many Prunes B gave A, besides the 20*l*? Ans. 17 C. 3 qrs. 4 *lb.*

9. C hath Candles. at 6*s* per dozen ready money; but in Barter he will have 6*s* 6*d* per dozen; D hath Cotton at 9*d* per *lb.* ready money; I demand what price the Cotton must be at in Barter: also how much Cotton must be bartered for 100 dozen of Candles? Ans. the Cotton is 9*d* 3 qrs. per *lb.* in Barter, and 7 C 0 qr. 16 lb of cotton must be given for 100 dozen of candles.

OF LOSS AND GAIN.

Q. WHAT is loss and gain?

A. Loss and gain is a rule which teaches merchants what they shall gain or lose in the sale of their goods, having the price that they bought them for, and the price for which they are to be sold both known.

Q. How are the following questions proved?

A. Let them be varied.

EXAMPLES.

1. Bought 18 C. of cheese, at 28*s* per C. which I sell out again at 3*d* $\frac{1}{2}$ per lb. what is the profit of the whole? Ans. 4*l* 4*s*.

2. If I buy deals at 20*d* a-piece, and sell them again at 17*d* what shall I lose by 120 dozen? Ans. 18*l*.

3. Hats bought at 4*s* a-piece, and sold again at 4*s* 9*d*. what is the profit in laying out 100*l*? Ans. 18*l* 15*s*.

4. Bought 19 fother of lead at 14*s* per C. what is gained by the whole, sold at 4*d* per lb? Ans. 432*l* 5*s*.

5. Bought 60 reams of paper, at 15*s* per ream, what is the loss in the whole quantity, at 4 per cent? Ans 1*l* 16*s*.

6. Bought 7 tons of wine, at 17*l* per hhd. which I sell again at 1*s* per pint; I demand the whole gain: and the gain per cent? Ans. 229*l* 12*s* whole gain; and 48*l* 4*s* 8*d* 1 qr $\frac{420}{473}$ the gain per cent.

7. If I sell 500 deals at 15*d* a-piece, and 9*l* per cent loss, what do I lose in the whole quantity? Ans. 2*l* 16*s* 3*d*.

8. I Bought 3 oxen for 24*l* 10*s* which I sell again for 2*s* per stone; what ought the 3 oxen to weigh together, the hides and offal being the only clear gain? Ans. 245 stone.

9. A draper bought 100 yards of broad cloth, for which he gave 56*l* I desire to know how he must sell it per yard, to gain 19*l* in the whole? Ans 13*s* per yard.

10. A draper bought 100 yards of broad cloth for 56*l* I demand how he must sell it per yard, to gain 15*l* in laying out 100*l*? Ans. 12*s* 10*d* 2qrs. $\frac{24}{100}$.

OF FELLOWSHIP.

Q. HOW many sorts of Fellowship are there?

A. Two: Single and Compound.

OF SINGLE FELLOWSHIP.

Q. What is Single Fellowship?

A. Single Fellowship is when the stocks of each partner *continue for* an equal term of time.

Q. What is the rule? A. As the sum of the several stocks,
Is to the total gain or loss;
So is each man's share in stock,
To his share of the gain or loss.

Q. How is this rule proved?

A. Add all the shares together, and the sum will be equal to the given gain or loss.

Note. This way of proving Fellowship will not hold good always, for if an error should be committed in the beginning of the work, and carried on through the whole operation, yet the same will prove, tho' each man's share of the gain or loss assigned him by that operation, be either more or less than his true share. The most exact method, then that I would propose, though something more tedious, is to change the order of the question, and put each man's Share of the gain or loss in the place of his stock first laid out, and make the sum of the stocks stand in the place of the whole gain or loss, and then it will be

As the total gain or loss
Is to the sum of the several stocks:
So is each man's share of the gain or loss
To his particular share in stock.

Q. What else doth this rule belong to besides Fellowship?

A. By it the estate of a bankrupt may be divided among his creditors: also legacies may be adjusted, when there is a deficiency of assets or effects.

Examples.

1. A and B were sharers in a parcel of merchandize, to the purchase of which, A laid out 3*l*, and B 7*l*, and the commodity being sold, they find their clear gain amounts to 25*s*, what part of it must each man have? Ans. A must have 7*s* 6*d* and B 17*s* 6*d*.

2. A, B and C, trading together, gained 120*l* which is to be shared according to each man's stock; A put in 140*l*. B 300*l*. and C 160*l*. what is each man's share? Ans. A 28*l*. B 60*l*. C 32*l*.

3. Three merchants trading to Virginia, lost goods to the value of 800*l*. Now if A's stock was 1200, B's 4800*l*. and C's 2000*l* what sum did each man lose? Ans. A lost 120*l*. B 480*l*, C 200*l*.

4 Three merchants traded together, and they put into one common stock 1000*l*. each man, and gained 600*l*. how much must each man have? Ans. 200*l*. each man.

5. A. B. and C trading to Guinea with 480*l*. 680*l*. and 840*l*. *in 3 years* time did gain 1010*l*. how much is each

man's share of the gain? Ans. A. 242*l.* 8*s.* B. 343*l.* 8*s.* C. 424*l.* 4*s.*

6. A. B. and C. freighted a ship from the Canaries to England, with 108 tuns of Wine, of which A. had 48; B. 36; C. 24; but by reason of bad weather they were obliged to cast 45 tuns overboard; how much must each man sustain of the loss? Ans. A. 20 tuns, B. 15 tuns, C. 10 tuns.

7. A merchant is indebted to S 70*l.* to T 400*l.* to V 140*l* 12*s* 6*d.* but upon his decease, his estate is found to be worth no more than 409*l.* 14*s.* how must it be divided among his creditors?

S must have	46*l.*	19*s.*	3*d.*	3 qrs.	$\frac{141750}{146550}$
T —	268	7	7	1	$\frac{77250}{146550}$
V —	94	7	0	2	$\frac{74100}{146550}$

8. If the money and effects of a bankrupt amount to 1400*l.* 14*s.* 6*d.* and he is indebted to A. 742*l.* 12*s.* to B. 641*l.* 19*s.* 8*d.* and to C. 987*l* 19*s.* 9*d.* how must it be divided among them?

Answ. A must have	438*l.*	8*s.*	4*d.*	1 qr.	$\frac{303527}{569117}$
B —	379	0	3	3	$\frac{158361}{569417}$
C —	583	5	9	3	$\frac{107529}{569417}$

OF COMPOUND FELLOWSHIP.

Q. What is Compound Fellowship?

A. Compound Fellowship is when the Stocks continue in unequal Term of Time.

Q. What is the Rule?

A. 1. Multiply each Man's Stock and Time together.
2. Add the several Products thence arising together.
3. As the sum of those Products,
Is to the whole Gain or Loss:
So is each Product,
To its Share of the Gain or Loss.

Q. How is this Rule proved?

A. As in Single Fellowship.

EXAMPLES.

1. Three Merchants traded together: A put in 120*l.* for 9 months; B 100*l.* for 16 months; and C 100*l.* for 14 months: and they gained 100*l.* how must it be divided?

Answ. A must have	26*l.*	9*s.*	4*d.*	3 qrs.	$\frac{3120}{4080}$
B —	39	4	3	3	$\frac{240}{4080}$
C —	34	6	3	1	$\frac{720}{4080}$

2. Three Merchants join in Trade: A put in 400*l.* for 9 months—B 680*l.* for 5 months—and C 120*l.* for 12

months: but by misfortunes lost Goods to the value of 500*l*. What must each man sustain of the Loss?

			L.	*s.*	*d.qrs.*		
Answ.	A must lose		213	5	4	3	2840 / 9440
	B	—	201	8	5	0	7840 / 9440
	C	—	85	6	1	3	6200 / 9440

3. A. B. and C. hold a Pasture in common, for which they pay 20*l*. per annum In this pasture A had 40 oxen for 76 days—B had 36 oxen for 50 days, and C had 50 oxen for ninety days. I demand what part every one of these Tenants ought to pay of the 20*l*. *L.* *s.* *d.qrs.*

Answ.	A ought to pay		6	10	2	1	2340 / 9340
	B	—	3	17	1	0	2000 / 9340
	C	—	9	12	8	2	5000 / 9340

OF EXCHANGE.

Q. WHAT is Exchange?

A. Exchange is the giving the Money, Weight, or Measure of one Country, for the like Value in Bills, Money, Weight or Measure of another Country.

Q. What is the Course of Exchange?

A. It is the value of money agreed on among merchants.

Q. Is the Course of Exchange always the same?

A. No—The course of Exchange rises or falls almost every day, according as money is plenty or scarce; or according to the time allowed for payment of the money in Exchange; and then the value is said to be above or under Par.

Q. What is the Par of Exchange?

A. It is the Intrinsic Value of any foreign Money compared with Sterling Money.

Q. What is Agio?

A. It is a Term used in some Countries abroad, especially in Italy, but never in England, and signifies the difference between the value of Bank-notes or Bank-money and Current-money, in such places—that is, it is the difference between the best Money used in the Terms of Exchange; and the worst used in Payment for Goods.

Q. What is meant by Bank-Notes or Bank-Money?

A. Bank-Notes are obtained from foreign Bankers, fi Money lodged in their Banks, which Money is calle Bank-Money.

Q. What is Current-Money?

A. It is such as passes from hand to hand, in the receiving and paying such Sums as are due from one Man to another; commonly called Running Cash.

Q. What is Usance?

A. It is a certain Time allowed for the Payment of Bills of Exchange; but different according to the Usage or Custom of the Place where the Bill is made compared with the distance of that place on which the Bill is drawn; that is, the nearer the place on which the Bill is drawn, is to the place where it was drawn, the time is the shorter; but the further those places are from each other, the length of the time allowed for the Payment of that Bill, from the date of it, is the greater.

Note. Bills are payable five ways, viz,

1. At Sight.
2. At so many Days after Sight.
3. At Usance, or a certain Length of Time agreed on between the two Places.
4. At Double Usance, which is Double the Time agreed on between the two Places.
5. Marts or Fairs, which is to be understood at some certain Days accounted for Fairs in the same Places where the Bills are made payable.

Q. What are Days of Grace?

A. In London it is customary so allow 3 days to the Time mentioned in the Bill, which are called days of Grace, on the last Day of which (if it be on a Sunday but if it is on Saturday) the Bill must be demanded, and if not then paid, must be immediately protested.

Note. In some places they allow a larger number of Days of Grace, than they do at London... and in others none at all.

Q. How are questions in Exchange proved?

A. By changing the order of them.

CASE 1.

Q. What places does London exchange with in Dollars, or Pieces of eight of Mexico?

A. With Madrid and Cadiz in Spain, and with Genoa, and Leghorn, in Italy.

Q. How do they keep their Accompts in Spain?

A. In Rials and Marvedies.

Note 372 *Marvedies make* 1 *Rial.*

8 *Rials* ——— 1 *Piece of Eight.*

Q. What is the par of exchange between London & Spain?

A. The Par of the Money between London and Spain is, that 1900 Rials are exactly equal to 51*l* Sterling—consequently 1 Rial is worth 6d. 1 qr. $\frac{7}{19}$.

Note, 1. Spain gives to London 1 dollar or piece of eight for an uncertain number of pence sterling.
2 In Spain they allow 14 days of grace.

Q. How do they keep their Accounts in Italy?

A. In Livres, Sols & Deniers; some few Cities excepted.

Note 1. 12 Deniers make 1 Sol.
20 Sols . . . 1 Livre.
5 Livres . . 1 Piece of Eight at Geneva.
6 Livres . . 1 Piece of Eight at Leghorn.
2. The Usance of Geneva to London is 3 Months after Date.
3. At Geneva they allow 30 Days of Grace.

Examples.

1. What is the amount of 63*l.* Sterling in pieces of Eight, at 56d per piece? Ans. 270 Pieces of Eight.

2. A Factor has sold Goods at Cadiz for 1468 Pieces of Eight, at 4s 6d 2 qrs. per piece; how much Sterling is the Sum? Ans 353*l.* 7s 2d.

A Bill of Exchange, viz. Leghorn on London.

Leghorn, July 31, 1781, for 786 Pieces of Eight of Mexico at 55d Sterling per Piece of Eight, at 3 Months.

Three months after date, Pay this my first of Exchange to Mr. James Le Morte, or Order, Seven Hundred and Eighty-Six Pieces of Eight of Mexico, for the Value received of himself, at 55d Sterling per piece, and place it to accompt, as per advice from Your humble Servt.

To Mr. William Mayhew, Merchant in London. James Douglass.

How much money must be received in England for this Bill? Ans. 180*l.* 2s 6d.

Case 2.

Q. What Place does London exchange with in Ducats?

A. With Venice in Italy.

Note. 6 Solidi make 1 Gross—24 Grosses —— 1 Ducat.

Q. What is the Par of Exchange between London and Venice?

A. One Hundred Livres are worth 3 pounds Sterling.

Q. How many sorts of Ducats are there at Venice?

A. Two sorts, viz. Ducats Banco, or Bank-Ducats which are usually given in Exchange; and Ducats Picoli, or Currant-Ducats which are usually bargained for and paid in the purchase of goods and merchandize, and are 20 per cent. worse than the Bank-Ducats.

Note. 1. The par of the ducat banco, is 52 pence sterling; and the par of the ducat Picoli is 40d. sterling.

2. The usance of Venice to London and back again is 3 months, or 90 days after date; two usance is that time doubled.

EXAMPLES.

1. If 100 Livres are worth 3*l.* Sterling, what is 1 Livre worth? Ans. 7d. $\frac{1}{2}$ Sterling.

2. There are 2000 Ducats at 4s. 4d. each remitted to London to be paid in Pounds Sterling, what is the amount? Answ. 433*l.* 6s. 8d.

3. A bill of 100*l.* Sterling is remitted to Venice, to be paid in Ducats, at 4s. 4d. each; what is the amount? Answ. 461 $\frac{78}{85}$ Ducats.

4. A Traveller would exchange 233*l.* 16s. 8d. Sterling, for Venice Ducats at 4s. 9d. per Ducat; how many must he have? Answ. 984 $\frac{12}{17}$ Ducats.

A Bill of Exchange, viz Venice on London.

Venice, August 17th, 1781, for 4000 Ducats Banco, at 54d. $\frac{1}{4}$ Sterling per Ducat, at Usance.

At Usance, pay this my first Bill of Exchange, to Mr. Abraham Jennings, or Order, Four Thousand Ducats, at Fifty-four Pence farthing Sterling per Ducat, Value received and place it to the accompt of

To Samuel Jones, Esq. Your humble Servant,
Merchant in London. William Sherston.

I demand the Value of this Bill in Sterling Money? Answ. 904*l.* 3s. 4d.

Another, viz. London on Venice.

London, September 14, 1781, for 904*l.* 3s. 4d. Sterling to be paid at Venice in Ducats, at 54d. $\frac{1}{4}$ sterling per Ducat Banco, at Usance.

At Usance, pay this my second Bill of Exchange, my first not paid, to Mr. Samuel Dobbins, or Order, Nine Hundred and four pounds, three shillings and four pence Sterling, in ducats, at fifty-four pence farthing per ducat, value in myself, and place it to accompt, as per advice from

To Mr. James Torriano, Your humble servant,
Merchant at Venice. Michael Tassio.

What is the value of this Bill in Ducats Banco? Ans. 4000 Ducats.

CASE 3.

Q. What places does London exchange with for French Crowns? Ans. with Paris, Lyons, Rouen, &c. in France?

Q. How do they keep their accounts in France?

A. In Livres, Sols and Deniers.

Note 1. 12 Deniers make 1 Sol.
20 Sols ——— 1 Livre.
3 Livres ——— 1 Crown.

2. The Livre is imaginary.

3. By an Order of Lewis XV. their money is brought to the English Standard for the Benefit of Trade.

Q. What is the Par of Exchange between London and France.

A. One Livre is worth 18d. Sterling—and one Crown is worth 4s. 6d. Sterling.

Note 1. In France they allow 10 Days of Grace—but when Bills are Drawn at Sight, they are payable the same Day.

2. The Usance between France and London is 1 Month consisting of 30 days.

EXAMPLES.

1. A Bill of 200*l.* is remitted to Paris by a Merchant in London—what is the value in French Crowns at 4s. 6d. each? Ans. 888 $\frac{8}{9}$ Crowns.

2. There are 800 French Crowns, at 4s. 6d. each remitted to London, by a Merchant in Paris.—What is the value in pounds sterling? Answ. 180*l.* sterling.

A Bill of Exchange, viz. Paris on London.

Paris, September 17, 1781, for 1000 Crowns, at 4s. 2d. at 2 Usance.

At double Usance, pay this my second Bill of Exchange, my first not paid, to Mr. James Jackson, or Order, the Sum of One Thousand Crowns, at four shillings and two pence, per crown, value received, and place it to accompt, as per advice of

To Mr. Simon Surepay, London. Your humble servant, Daniel Abbot.

What is the Value of this Bill in Sterling Money? Ans. 208*l.* 6s. 8d.

CASE 4.

Q. What places does London exchange with for Mill Reas?

A. With Oporto and Lisbon, &c. in Portugal—and with the Island of Madeira.

Q. How do they keep their accompts in Portugal?

A. In Reas.

Note 1. 1000 *Reas make* 1 *Mill Rea.*

2. *They separate the Reas from the Mill Reas, by some particular mark, thus* 687 ⊙ 496, *that is,* 687 *Mill-Reas and* 496 *Reas, which is the same with* 687496 *Reas.*

3. *Very near* 14 *Reas, or* 13$\frac{1}{3}$ *Reas make* 1 *penny Eng.*

Q What is the Par of Exchange between London and *Portugal.*

A. One Mill-Rea is worth 5s. 7d. $\frac{1}{2}$. which appears thus;

800 Reas (or 8 Testoon Piece) are	=	4s.	6d.
200 Reas (or fourth part) are	=	1	$1\frac{1}{2}$
1000		5	$7\frac{1}{2}$

Note, The usance between London and Portugal is two months, or 60 days after date.

EXAMPLES.

1. If a Bill is drawn from Lisbon of 1432 Mill-Reas, at 6s. 8d. per piece—how much English Money is that Bill? Ans. 477*l.* 6s. 8d.

2. If a Bill be drawn from London of 1333*l.* 6s. 8d. Sterling, how much is it at Lisbon in Mill-Reas, 6s 8d each? Ans. 4000 Mill-Reas.

A Bill of Exchange, viz. Lisbon to London.

Lisbon, Oct. 14, 1781, for 4761⊙764, at 5s 8d at Usance.

At Usance pay this my first of Exchange to Mr. Henry Sozamon, or Order, Four Thousand Seven Hundred and Sixty-one Mill-Reas, Seven Hundred and Sixty-four Reas, at Five Shillings and Eight Pence Sterling per Mill-Rea, value received; and place it to the Accompt of

To Mr. John Joliffe, Merchant in London. Your humble Servant, John Minors.

What is the value of this Bill in Sterling Money? Ans. 1349*l* 3s. 3d. 3 qrs. $\frac{808}{1000}$.

CASE 5.

Q. What place does London exchange with for Ducatoons, Crowns or Ecues?

A. With Florence in Italy.

Q. How do they keep their accounts in Florence?

A. In Ecues, Sols and Deniers, Pecoli or Current.

Note. 12 Deniers make 1 Sol.

20 Sols . . 1 Ecue, Crown or Ducatoon.

Q. What is the Par of Exchange between London and Florence?

A. One Ecue, Crown or Ducatoon is worth 60d Sterling.

Note. The Usance between Florence and London, is 3 Months, or 90 days after date.

EXAMPLES.

1. A Bill of 120 Ducatoons is remitted from Florence, at 53d each—what is the value in pounds sterling? A. 26*l* 10s.

2. A Bill of 220*l* 16s. 8d, is drawn from London, what is the value at Florence in Ducatoons, or Ecues, 53d $\frac{1}{3}$ each? Ans. 990 $\frac{70}{107}$ Ecues.

A Bill of Exchange, viz. Florence on London.
Florence, October 19, 1871, for 1786 Ecues at 63d Sterling per Ecue, at Usance.

At Usance pay this my third of Exchange, my first & second not paid, to Mr. Jonathan Fermon, or order, one Thousand Eight Hundred Seventy-six Ecue ; at 63d Sterling per Ecues, value received, and place it to the accompt of

To Mr. John Jameson, Merchant in London.

Your humble Servant, Michael Tassioni.

What is the Value of this Bill in Sterling Money,? Ans. 492*l* 9s.

CASE 6.

Q. What place does London exchange with for Florins?

A. With Frankfort in Germany.

Q. How do they keep their accompts in Frankfort ?

A. In Goulds, Cruitzers and Deniers, or Pennings.

Note. 8 Penning, or 4 Deniers make 1 Cruitzer.
60 Cruitzers, ... 1 Gould or Guilder.

Q. What is the Par of Exchange between London and Frankfort?

A. Twentv Florins are equal to 3*l*. Sterling.

Note. When they exchange or negociate Bills for London, Holland or Flanders, the Bills are paid in Goulds or 65 Cruitzers—and for France, Hamburgh and Italy, in Goulds of 60 Cruitzers—and sometimes in Rix-Dollars, at 4s. 6d. sterling, and at so much per cent. profit or loss.

EXAMPLES.

1. If 20 Florins are equal to 3*l*. Sterling, what is the worth of 1 Florin? Ans. 3s. sterling.

2. If 1000*l* sterling be remitted to Frankfort, what is the value in Florins at 39d. per piece ? Ans. 6153 $\frac{33}{39}$.

3. If 100 Florins at 40d $\frac{1}{2}$ each be remitted from Frankfort to London, what is the value in *l*. sterling ? Answ. 16*l* 17s 6d.

A Bill of Exchange, viz. London on Frankfort.
London, September 12, 1781, for 763*l* 10s sterling, to be paid in Florins at 41d. sterling each, at Usance.

At Usance, pay this my second of exchange, my first not paid, to Mr. Jacobus Sanderson, or Order, Seven Hundred Sixty-three pounds, Ten Shillings sterling in Florins at 41d sterling, per Florin, Value received, and place it to accompt as per advice from

To Mr. William Maron, *Merchant* in Frankfort.

Your humble servant, James Johnson.

What is the value of this bill in Florins? Answ. 4469 $\frac{1}{41}$ Florins.

CASE 7.

Q. What places does London exchange with by the pound Flemish or pound Sterling?

A. With Antwerp, Brussels, Amsterdam, Rotterdam, and all parts of the Spanish and United Provinces. Also with Hamburgh in Germany.

Q. How do they keep their accounts in these places?

A. Some in pounds, shillings, and pence, as in England; and others in guilders, stivers, and pennings.

Note. 16 Pennings make 1 Stiver.
20 Stivers . . 1 Guilder. Also
6 Stivers . . 1 Shilling.
6 Guilders . . 1 Pound Flemish.

2. The par of exchange between London, and Holland is, that 9*l.* sterling are equal to 100 Florins.

3. A Florin is worth 3s. 2d.$\frac{2}{3}$ Flemish.

4. The prices of the exchange at London, Humburgh, and Amsterdam, are said to have a very great influence upon all the rest of Europe.

Q. what is the par of exchange between London and Antwerp?

A. Sixteen pounds Flemish are equal to nine pounds sterling: so that 1*l* Flemish is equal to 11 shillings and 3d sterling, and 1*l* sterling is equal to 35*s* 6*d* $\frac{2}{3}$ Flemish.

EXAMPLES.

1. Being desirous to remit to my correspondent at London, the sum of 2000*l* 12*s* 6*d* Flemish, to dispose of according to my order, exchange at 34*s* 6*d* Flemish per pound sterling; how much money sterling shall I be creditor for in the city of London aforesaid? Ans. 1159*l* 15*s* 7*d* 3 qrs.$\frac{126}{414}$.

2. My correspondent in England gives me notice that he has disbursed in merchandize, upon my account, the sum of 1000*l* sterling; what sum must I answer for that in Holland, the course of exchange being at 33*s* 4*d* Flemish for one pound sterling? Ans. 1666*l* 13*s* 4*d*.

Note. When the Course of Exchange is at 34s 4d Flemish for 1 pound sterling, then to bring Flemish money into English money multiply the Flemish money by 3,and divide that product by 5,the quotient will give the answer in pounds sterling, and the contrary.

3. My correspondent in Rotterdam sends me word, that he has disbursed upon my account the sum of 3060 guil

ders and 15 stivers; what sum must I answer for that at London, the course of exchange being at 37*s* 9*d* Flemish per *l.* sterling? Ans. 270*l* 5*s* 3*d* 2qrs. $\frac{138}{455}$.

Note. A stiver is 2d flemish, and a guilder 40d.

4. A merchant delivered at London 120*l* sterling, to receive 147*l* Flemish in Amsterdam; how much was 1*l* valued at in Flemish money? Ans. 1*l* 4*s* 6*d*.

5. If 1 florin is worth 3*s* 2*d* $\frac{2}{5}$ Flemish, and 100 florins are equal to 9*l* sterling; how much is the real worth of 1*l* sterling in Flemish money? Ans. 35*s* 6*d* $\frac{6}{9}$.

1 fl . 3*s* 2*d* $\frac{2}{5}$ :: 100 fl : 16*l* Flem.
9 : 16 :: 1 :: 35*s* 6*d* $\frac{6}{9}$ Flem.

Of Reducing the Current Money of *Holland* into Bank-Money, and the contrary.

Examples.

1. Being in Holland, I have 1000 guilders current-money, which I would turn into bank-money, the agio being at 5 guilders per cent, how much is it? Ans. 952 guilders banco. $\frac{40}{105}$.

C. Cur. G. B. G Cur. G. B.
105 : 100 :: 1000 : 952 $\frac{40}{105}$.

2. My correspondent in Amsterdam having wrote me word, that he had by him of mine 2763 guilders, 15 stivers, currency, I have directed him to turn the same into bank-money, the agio being (as I am informed) 5 guilders $\frac{1}{2}$ per cent, I demand how much bank-money it will make? Ans. 2619 guilders, 13 $\frac{77}{211}$st. bank money.

G. Cur. G. B. G. S. Cur. G. B. S.
105 $\frac{1}{2}$: 100 :: 2763 „ 15 : 2619 13 $\frac{77}{211}$.

3. Holland is indebted to London 7681 guilders, current money, and would know how much sterling it will amount to, exchange at 35*s* 6*d* banco per *l*, sterling, agio at 5 per cent, how much is it? Ans 686*l* 17*s* 6*d* $\frac{60}{456}$ sterling.

G.C. G. B° G. C. G. B° St. Pen.
105 : 100 :: 7681 : 7315 4 12 $\frac{20}{105}$.
s. d. l. st. G. B° S. P.
35 6 . 1 : 7315 4 12 : 686*l* 17*s* 6*d*.

4. Amsterdam remits to London 1090 guilders, 17 $\frac{1}{2}$ stivers, at 33*s* 8*d* banco per *l*. sterling: what will this remittance amount to at London in sterling money. Ans. 108*l* 0*s* 1*d* 3qrs. $\frac{62}{101}$ sterling.

Note, The above money is supposed to be reduced into bank money already.

s. d. l. St G· St.B° *l. s. d.* qrs
33 8 . 1 : 1090 „ 17 $\frac{1}{2}$. 108 0 1 $\frac{3}{4}$ $\frac{62}{404}$.

OF THE SALE OF GOLD IN HOLLAND.

Note. All gold is bought and sold at Amsterdam by weight; that is, 355 guilders current per mark of that weight.

Examples.

A Merchant in London sends over to his Correspondent at Amsterdam, 1000 Moidores, valued at 27s. sterling each; the charges on shipping came to 5*l.* 19s. 6d. When they come to the place consigned and were weighed they amounted to 14209 Guilders 14 Stivers Currency, all charges there deducted—I demand what was their value in English money, and how much the London Merchant gained or lost by his Moidores admitting the Agio to be 5 Guilder per cent. and the course of Exchange 33s. 6d. B° Flemish per *l.* sterling? Answ. 12*l.* 15s. 4d. loss.

1. 1000Ms+5*l.* 19s 6d=1355*l* 19s 6d.
   G. G. G. St. G. St.
2. 100 : 5 :: 14209 „ 14 : 710 9
   Gu. St. Gu. St. Gu. St.
3. 14209 „ 14 — 710 „ 9 = 13499 „ 5
   s. d. l. G. St. L. s. d.
4. 33 6 : 1 :: 13499, 5 : 1343 4 2
5. 1355*l* 19s 6d.—1343*l* 4s 2d=12*l.* 15s 4d.

A Bill of Exchange, viz. London on Rotterdam.

London, September 14, 1781, for 436*l.* 17s. sterling, at 34s. 6d. Flemish per *l.* sterling at Usance.

At Usance pay this my first of Exchange, to Jacob Van Horne, or Order, Four Hundred Thirty-six pounds, seventeen Shillings sterling, value received of William Johnson, Esq. and place it to accompt, as per advice from

To Mr. James Juliers, Merchant, Rotterdam.

Your humble servant, Thomas Cartwright.

What is the Value of this Bill in Flemish Money? Answ 753*l.* 11s. 3d. 3 qrs. $\frac{12}{20}$.

Also in Guilders and Stivers? Answ. 4521 Guild. 7 St.

s. d.	*l. s.*
34 6	436 17
12	414
414	1747 8
	4368 5
	174740 0

4|0)18085|5 15(4521 7 Answ. *Gu. St.*
15

Another, viz. Rotterdam on London.

Rotterdam, September 19, 1781, for 7693 Guilders 17 Stivers at 35s. 6d. Flemish per pound sterling.

At Usance pay this my second Bill of Exchange, my first not paid, to James Truelove, or order, Seven Thousand Six Hundred Ninety-Three Guilders, Seventeen Stivers, at 35s 6d Flemish per *l.* sterling. Value received of Jacques Jacobson, and place it to accompt, as per advice from

To James Jolles, Esq. Merchant at London.

Your humble servant, Johannes Van Schooten.

What is the Value of this Bill in Sterling Money? Answ. 722*l.* 8s. 6d. 2 qrs. $\frac{60}{428}$

To know how much is gained or lost per cent. on the rising or falling of the Price of Exchange.

EXAMPLES.

1. London draws upon Holland, for any sum of money, exchange at 35s 6d Flemish per *l.* sterling: in 3 weeks or 1 month afterwards, London draws on Holland again, exchange at 34s. 6d. I demand what London gains per cent. by this Negociation? Ans. 2*l.* 17s. 11d. 2 qrs. $\frac{252}{414}$ gain.

s. d. s. l. l. s. d.

34 6 : 1 :: 100 : 2 17 11 2 qrs $\frac{252}{414}$

2. London draws upon Amsterdam, exchange at 34s. 6d. Flemish per *l.* sterling; and in 5 weeks time draws again, the exchange being at 35s. 6d. how much is lost per cent. by this transaction? Ans. 2*l.* 7s. 11d. 2 qrs. $\frac{252}{414}$.

Note, Hence it is to be observed, that the lower the price of exchange is, the greater is the gain at London, and the contrary, when it is higher: but the case is just the reverse at Holland.

CASE 8.

Q. What places does London exchange with by the Pound Sterling or Pounds Currency?

A. In all the British Dominions in America, in the West-Indies, and in Ireland.

Q. How do they keep their accounts in these places?

A. As they do in London, that is, in pounds, shillings, pence and farthings; but with this difference, that in London they call their money sterling, but in all the Western Dominions they call it currency.

Q. Why is the money called Currency in the Western Dominions?

A. Because they have very few Coins of any sort circulating among them; excepting in the English Islands there, & *therefore are obliged* to deal in what they call Paper-money.

1. Notes of hand pass currently among the people: and -England, they are said to be given for so small a sum as 5 s. Now as this paper money is subject to many casualties, es a very great undervaluement of their currency, and is nes, and in some places, at 6 or 700 pounds currency for 100 sterling, or money that is good silver or gold.

all the English islands in the West-Indies, they have so plenty of foreign coins, that their currency is sometimes at ıter discount than 25 per cent, or 125l. currency for 100 ;, and seldom more than 50 per cent.

ıe weights and measures in the British colonies and planta- are the same as those in London, differing only in their ı or hundred weight, their hundred being only 100lb avoir- and that at London 112lb.

What foreign coins usually pass in the British co- and plantations?

These following; the values of which were ascer- ı by an act of parliament made in the 6th year of n Anne.

	Weight		*Tr Val*		*Cur Val*		
	dwtsgr		*s*	*d*	*s*	*d*	*f*
s of Eight (old plate of Seville)	17	12	4	6	6	0	0
of new - - - -	17	0	3	7¼	4	9	2⅖
ico do. - - - - -	17	12	4	6	6	0	0
do. - - - - -	17	12	4	6¾	6	0	0
do. (old plate) - -	17	12	4	5	5	10	2⅖
s dollars - - -	18	0	4	4¾	5	10	1⅕
ıtoons of Flanders - -	20	21	5	6	7	4	0
ch crowns or ecues -	17	12	4	6	6	0	0
adoes of Portugal - -	11	4	2	10½	3	9	2⅖
e guilder pieces of Holland	20	7	5	2¼	6	10	3⅖
ix dollars of the empire -	18	10	4	6	6	0	0

te 1. Pieces of the same weight, and not of the same value, ɔe presumed to be occasioned by the difference of fineness. To remedy the inconveniencies which were caused by the ent rates at which pieces of the same species were current, s ordered by proclamation, and confirmed by the aforemen- d act of parliament, that after the first day of January, 1704, llar, Mexico, or Seville pieces of Eight, though of full weight ove, shall be received nor paid at above 6 Shillings a piece, he halves, quarters, and other lesser pieces in proportion. the said act enjoins, that if any one shall receive or pay any e above pieces for any more than is above specified, such ɔn shall forfeit ten pounds.

Examples.

A merchant in New-England stands indebted to hi ɛspondent in London in 4960l 17s. 6d. currency; wh

sum must he answer for that at London aforesaid, when the currency is at 300 per cent? Ans. 1653*l* 12*s* 6*d* sterling.

2. My correspondent in Georgia stands indebted to me for merchandize, in the sum of 120*l*. 6*s* 9*d* $\frac{1}{2}$ sterling; how much is that in their currency at 500 per cent? Ans. 601*l*. 13*s* 1 1*d* $\frac{1}{2}$ currency.

3. Trading to Jamaica, my employer there owes me 176*l*. 12*s* 8*d* sterling, how much is that in their country, at 25 per cent? Ans. 220*l*. 15*s* 10*d* currency.

4. I have lately purchased in Ireland, effects to the value of 400*l* 17*s* 9*d* of that place; what sum must I answer for that at London, exchange at 10 per cent? Ans. 364*l* 8*s* 10d 1 qr $\frac{120}{164}$

5. My correspondent at London, draws, upon me for 364*l* 8*s*. 10*d* $\frac{1}{2}$ sterling, what sum must I answer for that at Dublin, exchange at 8$\frac{1}{2}$ per cent? A. 395*l*. 8*s* 5d$\frac{146}{960}$.

Case 9.

Q. What places does London exchange with for the crown or rix dollar?

A. With Geneva and Switzerland.

Q. How do they keep their accompts in Geneva?

A. In livres, sols, and deniers.

Note. 12 Deniers make 1 Sol.
20 Sols ——— 1 Livre.
3 Livres ——— 1 Rix-Dollar.

2. The par is, that 1 Rix-Dollar is equal to 4s 6d sterling: but in exchange it goes for 50d to 60d sterling.

Examples.

1. London draws upon Geneva for 796*l* 10*s* 6*d* sterling; what sum does that amount to in rix-dollars, at 53*d* per dollar? Ans. 3606$\frac{48}{53}$ rix-dollars.

2. A merchant in Geneva draws upon his correspondent at London for 1960 livres, exchange at 56*d* per rix-dollar; how much sterling must be paid at London to answer that bill? Ans. 152*l* 8*s* 10*d* $\frac{1}{2}$.

$\frac{1960}{3}$=653$\frac{1}{3}$ 1 : 56 :: 653$\frac{1}{3}$: 152*l* 8*s* 10*d* $\frac{1}{2}$+

A Bill of Exchange, viz. London on Geneva.

London, October 19, 1781, for 376*l*. 11*s* 8*d* sterling, to be paid in rix-dollars, at 58*d* sterling each at usance.

At usance, pay this my only bill of Exchange to Mr. Janson Gramonville, or order, three hundred seventy-six *pounds, eleven* shillings and eight pence, sterling, in

Rix-Dollars, at 58d. sterling per Rix-Dollar, value received, and place it to the accompt of

To Mr. Abraham Sculhausen, Merchant in Geneva.

Your humble servant, Jacobus Schomberg.

Q. What is the value of this Bill in Rix-Dollars? Ans. 1558$\frac{14}{58}$ Rix-Dollars.

CASE 10.

Q. What particular piece of money does London exchange with Denmark for?

A. For Rix-Dollars; one being valued at about 4s. 6d. Sterling.

Q. How do they keep their accompts in Denmark?

A. In Marks and Shillings.

Note 1. 16 Shillings make 1 Mark.
6 Marks - - - 1 Rix-Dollar.

2. The Rix-Dollar in exchange, goes for 45d. to 58d. Sterling.

EXAMPLES.

1. London draws on Copenhagen in Denmark, for 184*l.* 16s. 7d. sterling; what sum must be answered for that in Rix-Dollars, at 50d. each? Answ. 887$\frac{9}{10}$ dollars.

2. My Correspondent in London, stands indebted to me, according to my books, in the sum of 1000 Rix-Dollars, what sum must he answer for that at London aforesaid, when the Rix-Dollar by way of exchange, is valued at 58$\frac{1}{2}$d? Answ. 243*l.* 15s.

3. A Merchant in London draws upon his Correspondent in Copenhagen, for 400*l.* sterling, but will give no more for a Rix-Dollar than 55d. sterling, that being the price of exchange how many Rix-Dollars must he receive, and what is his whole loss and the loss per cent. they being above Par? Answ. 1745 $\frac{25}{55}$ Rix-Dollars—The whole loss was 7*l.* 5s. 3d. and the loss per cent. was 1*l.* 16s. 3d $\frac{3}{4}$.

d. Dol. l. Dol.
55 : 1 :: 400 : 1745$\frac{25}{55}$
1745$\frac{1}{2}$ at 4s. 6d.=392*l.* 14s. 9d. at Par.
400*l.*—392*l.* 14s. 9d.=7*l.* 5s 3d. loss.
$\frac{7}{4}$ $\frac{5}{4}$ $\frac{3}{4}$=1*l.* 16s. 3d. $\frac{3}{4}$ loss per cent.

CASE 11.

Q. What places does London exchange with for the Copper-Dollar?

A. With Stockholm in Sweden.

Q. How do they keep their accounts in Stockholm?

A. In Rix-Dollars, Copper-Dollars, and Runstics.

Having given several bills of exchange to be reduced into sterling or foreign money; it may not be amiss to give the Form how a Bill-Book should be kept, that a Merchant may know at Sight, what Bills he has to pay, and what to receive; and when to pay and receive them.

1. Bills Payable, i. e. such as you have accepted.

The Drawer's name and place of residence.	Date of the Bill.	The time of payment.	Payable to whom or Order.	The Sum drawn for.	Price of exchange.	For or by whom accepted, and place of abode.	The Sum sterling.	When due.	Paid, or refused acceptance.
Wm. Sherston, of Venice.	17 Aug.	3 months.	Abra'm Jennings.	Ducat Bo. 4000.	Sterl. 54*d.* $\frac{1}{4}$	Wm. Denny, Rood Lane.	*l.* *s.* *d.* 204 3 4	15 Nov.	Paid.

2. Bills receivable, i. e. such as you have in your possession.

The Drawer's name and place of residence.	Date of the Bill.	The time of payment.	Payable to whom or order.	The Sum drawn for.	Price of exchange.	For or by whom accepted, and place of abode.	The Sum Sterling.	When due.	Received, or returned protested for non-acceptance or non-payment.
M. Tassioni, Florence.	19 Oct.	3 months.	James Edward.	Ecues 1876.	Sterl. 63d.		*l.* *s.* 492 9	17 Jan.	Protested for non-acceptance.

Note 1. 32 Runstics make 1 Copper-Dollar.
6 Copper-Dollars 1 Rix-Dollar.

2. The par of the Rix-Dollar is equal to about 6s. sterling—consequently the par of the copper-dollar is equal to 1s. sterling or 20 copper-dollars make 1*l.* sterling, though the course of Exchange is sometimes to 28 or 30 copper-dollars per pound sterling.

3. In England sums of money are paid in the best specie, viz. Guineas, by which means 1000*l.* or more may be put into a small bag, and conveyed away in the pocket—but in Sweden they often pay sums of money in copper, and the Merchant is obliged to send wheelbarrows instead of bags to receive it.

Examples.

1. A merchant in Stockholm draws upon his correspondent in London for 1184 Rix-Dollars; what sum must he answer for that in London aforesaid, when the course of exchange is at par? Ans. 355*l.* 4*s.*

2. Stockholm draws upon London for 1276 rix-dollars: what sum must London answer for that, exchange at 25 copper dollars per *l.* sterling, and what is gained or lost by the drawer at Stockolm aforesaid? Ans 306*l* 4*s.* 9*d.* 2 qrs. $\frac{2}{3}$ the bill, and the drawer loses 76*l* 11*s.* 2*d.* 1 qr. $\frac{3}{5}$.

25 : 1 :: 1276×6 : 306 4 9 $2\frac{2}{3}$ the value of the bill.
25 : 5 :: 7656 : 76 11 2 $1\frac{3}{5}$ loss.

Case 12.

Of the Comparison of Weights and Measures.

Examples.

1. If 112 lb. at London make 99 lb. at Lisbon, how many lb. at London are equal to 1049 lb. at Lisbon? Ans. 1186 lb. $\frac{74}{99}$

2. If 112 lb. at London make 98 lb. at Roan, how many lb. at Roan are equal to 1000 lb. at London? Ans 875 lb.

3. If 100 ells English make 108 braces at Venice, how many ells English are equal to 1000 braces at Venice?
Ans. 925 ells, 4 qrs. 2 na. $\frac{56}{108}$.

4. If 100 ells at London make 145 ells at Vienna, how many ells at Vienna are equal to 10 ells at London?
Ans. 14 ells $\frac{1}{2}$.

Note, Hence appears the reason of those rules, laid down in conjoin'd proportion, for placing the last number in the question either in the right hand, or the left, as the nature of the question requires.

lb. Lis. lb. Lon. lb. Lis.
Ex. 1. 99 : 112 :: 1049
lb. *lb.*
112 = 99
1049

lb. Lon. lb. R. lb Lon.
Ex. 2. 112 : 98 :: 1000
lb. lb.
112 = 98
1000

OF THE DOUBLE RULE OF THREE.

Q. BY what is the Double Rule of Three known ?

A. By five Terms which are always given in the question to find a sixth.

Q. In what proportion is the sixth term to be found ?

A. If the proportion is direct, the sixth term must bear such proportion to the fourth and fifth, as the third bears to the first and second ; but if the proportion is inverse, then the sixth term must bear such proportion to the 4th and fifth, as the first bears to the second and third, or as the second bears to the first and third.

Note, It is to be observed here, as in the single rule of three, that direct proportion is when more requires more, or less requires less, and inverse proportion is when more requires less, or less requires more.

Q. What do you observe concerning the five given terms ?

A. That the three first terms are a supposition ; the two last are a demand.

Q. How must the numbers given in the question be stated ?

A. By two single Rules of Three ; or otherwise, thus,

1. Let the principal cause of loss or gain, interest or decrease, action or passion, be put in the first place.

2. Let that which betokeneth time, distance of place and the like, be put in the second place ; and the remaining one in the third place.

3. Place the other two terms under their like in the supposition.

4. If the blank falls under the third term, multiply the first and second terms for a divisor, and the other three for a dividend.

5. If the blank falls under the first or second term, multiply the third and fourth terms for a divisor, and the other three for a dividend, & the quotient will be the answer.

Q. How are the following questions proved ?

A. Let them be varied ; or else work the same questions by two single rules of Three.

EXAMPLES.

1. If 7 men can reap 84 acres of wheat in 12 days, how many men can reap 100 acres in 5 days ? Ans 20 men.

2. If 7 qrs. of malt are sufficient for a family of 7 persons for 4 months ; how many qrs. are enough for 46 persons 10 months ? Ans. 115 qrs.

3. If 8 reapers have 3*l*. 4*s*. for 4 days work; how much will 48 men have for 16 days work? Ans. 76*l*. 16*s*.

4. If 10 bushel of oats be enough for 18 horses 20 days, how many bushels will serve 60 horses 36 days? Ans. 60 bu.

5. If a footman travels 240 miles in 12 days, when the days are 12 hours long; how many days may he travel 720 miles in, of 16 hours long? Ans. 27 days.

6. If 56 lb. bread will be sufficient for 7 men 14 days, how much bread will serve 21 men 3 days? Ans. 36lb.

7. If 700*l* in half a year raise 14*l* interest, how much will 400*l* raise in 5 years? Ans. 80*l*.

8. If 30*s* be the hire of 8 men for 3 days, how many days must 20 men work for 15*l*? Ans. 12 days.

9. If 4 reapers have 24*s* for three days work, how many men will earn 4*l* 16*s* in 16 days? Ans. 3 men.

10. An usurer put out 86*l* to receive interest for the same; and when it had continued 8 months, he received for principal and interest 88*l* 17*s* 4*d*. I demand at what rate per cent per annum he received interest? Ans. 5*l* per cent.

11. What is the interest of 200*l* for 3 years and $\frac{3}{4}$, at 5 per cent per annum? Ans 37*l* 10*s*.

12. What is the interest of 100*l* for a week at 5 per cent per annum? Ans. 7*s* 8*d* 1 qr $\frac{1}{5}\frac{3}{2}$.

13. What is the interest of 120*l* for 126 days, at 4 per cent per annum? Ans 1*l* 13*s* 1*d* 2 qr. $\frac{2}{3}\frac{5}{6}\frac{3}{5}$.

Note, The rule of working questions in simple interest for days, p. 95. is taken from this rule, as appears from this last example.

OF CONJOIN'D PROPORTION.

Q. What is Conjoin'd Proportion?

A. Conjoind Proportion is when the coins, weights or measures of several countries are compared in the same question; or it is a linking together of many proportions.

Case 1.

Q. How are questions answered in this case?

A. When it is required to know how many of the first sort of coin, weight, or measure mentioned in the questions, are equal to the given number of the last then

1. Place the numbers alternately, beginning at the left hand, and let the last number stand on the left hand.

2. Multiply the first rank continually for a dividend and the second for a divisor.

Note. See the note in comparison of weights and measures p. 123 for the reason of this rule.

Q. How is Conjoin'd Proportion proved?

A. Make as many single rules of three as the nature of the question requires.

EXAMPLES.

1. If 100 lb. English make 95 lb. Flemish, and 19 lb. Flemish 25 lb at Bolonia, how many lb. English are equal to 50 lb. of Bolonia? Ans. 40 lb. English.

2. If 25 lb. at London be 22 lb. at Nuremburgh; 88 lb. at Nuremburgh 92 lb. at Hamburg; 46 lb. at Hamburg; 49 lb. at Lyons; how many pounds at London are equal to 98 lb at Lyons? Ans. 100 lb.

3. If 6 braces at Leghorn make 3 ells English, 5 ells English 9 braces at Venice how many braces at Leghorn will make 45 braces at Venice? Ans. 50 braces at Leghorn.

4. If 3 ells English make 6 braces at Leghorn, and 150 braces at Leghorn 135 braces at Venice, how many ells English are equal to 27 braces at Venice? Ans. 15 ells English.

CASE 2.

Q. How are questions answered in this case?

A. When it is required to know how many of the last sort of corn, weight or measure, mentioned in the question, are equal to a given number of the first; then

1. Place the numbers alternately, as in case 1, but let the last number stand on the right hand.

2. Multiply the second rank for a dividend, and the first for a divisor.

EXAMPLES.

1. If 10lb. at London make 9lb. at Amsterdam; 90lb. at Amsterdam 112lb. at Thoulouse; how many pounds at Thoulouse are equal to 50lb. at London? Ans. 56lb. at Thoulouse.

2. If 20 braces at Leghorn be equal to 10 vares at Lisbon; 40 vares at Lisbon to 80 braces at Lucca; how many braces at Lucca are equal to 100 braces at Leghorn? Ans 100 braces at Lucca.

OF ALLIGATION.

Q. HOW many kinds of Alligation are there?

A. Two: Alligation Medial, and Alligation alternate.

OF ALLIGATION MEDIAL.

Q. What is Alligation Medial?

A. Alligation Medial, is when the quantities and prices of several things are given to find the mean price of the mixture compounded of those things.

Q. What is the Rule?

A. As the whole Composition,
Is to its Total Value:
So is any part of the Composition
To its mean price.

Q. How is Alligation Medial proved?

A. Find the value of the whole mixture at the mean rate; and if it agrees with the total value of the several quantities at their respective rates, the work is right.

EXAMPLES.

1. A farmer mingled 19 bushels of wheat at 6*s*. per bushel, and 40 bushels of rye at 4*s*. per bushel, and 12 bushels of barley at 3*s*. per bushel, together; I demand what a bushel of this mixture is worth? Ans. 4*s*. 4*d*. 1 qr. $\frac{4}{7}$.

2. A farmer mingled 20 bushels of oats at 2*s* per bushel, and 30 bushels of beans at 2*s*. per bushel, and 20 bushels of peas, at 3*s*. per bushel, together; I demand the worth of a bushel of this mixture? Ans 2*s*. 3*d* 1 qr. $\frac{5}{7}$.

3. A vintner mingled 5 gallons of Canary, at 8*s*. per gallon, and 6 gallons of Malaga, at 7*s*. per gallon, and 4 gallons of white wine, at 6*s*. per gallon, together; I demand what a gallon of this mixture is worth? *Ans*. 7*s* 0*d* 3 qrs. $\frac{1}{5}$.

4. *A* grocer mingles 2 C. of sugar at 56*s* per C. and 1 C. at 43*s* per C. and 2 C. at 50*s*. per C. together; I demand the price of 3 C. of this mixture? *Ans*. 7*l* 13*s*.

5. *An* alehouse-keeper mixed 3 sorts of ale together, viz. 12 gallons at 6*d*. per gallon, 16 gallons at 7*d*. per gallon, and 21 gallons at 9*d* per gallon—I demand what 1 gallon of this mixture is worth? *Ans*. 7*d*. 2 qrs. $\frac{2}{49}$.

6. *A* refiner having 5 lb. of silver bullion, of 8 oz. fine 10 lb. of 7 oz. fine, and 15 lb. of 6 oz. fine, would melt all together—I demand what fineness 1lb. of this mass shall be? *Ans*. 6 oz. 13 dwts. 8 grs. fine.

7. *A* mint-master hath 3 lb. weight of gold, of 22 carrats fine, and 3 lb. of 20 carrats fine—I demand what fineness an oz. of this mixture will bear? *Ans*. 21. car. fine.

8. An hostler mixing provender for his horses, would put in a quantity of beans at 5*s*. per bushel, with the like quantity of oats, at 3*s*. 6*d*. per bushel—I demand the price of a bushel of this mixture? Ans, 4*s*. 3*d*.

9. A malster hath several sorts of malt, viz. one sort at 4*s*. 6*d*. another at 4*s*. and another at 3*s*. 6*d* per bushel; and he would mix an equal quantity of each together; I demand the price of a bushel of this mixture? Ans. 4*s*.

10. A brewer had several sorts of ale, viz. one sort at 20*s* per barrel, another at 25*s*. a third at 30*s*. and a fourth at 35*s*. per barrel; and he would mix an equal quantity of each together; I demand the price of a barrel, and also of a gallon of this mixture? Ans. 27*s*. 6*d*. per barrel, and 10*d*. 1*qr*. $\frac{8}{31}$ per gallon.

OF ALLIGATION ALTERNATE.

Q. What is Alligation Alternate?

A. Alligation Alternate is, when the rate of several things are given to find such quantities of them as are necessary to make a mixture, which may bear a certain rate propounded.

Q. How are the rates or prices of the given things to be ordered?

A. 1. They must be placed one over the other, and the propounded price of the composition against them—thus,

mean rate 7 { 4 Prices 5 of the 6 Simples.

2. Link the several rates together, in such sort, that one greater than the mean rate may be coupled to another which is less.

3. Take the difference between the mean rate, and the several prices, and place them each against his yokefellow—and for the rest, observe the following cases.

Case 1.

Q. What do you observe in this first case?

A. When the prices of the several things, together with the mean rate of the mixture are given, without any quantity to find how much of each ingredient is required to compose the mixture—take the difference between each price, and the mean rate, and set them alternately, and they will be the quantities required.

Q. How are the operations in this and the following cases proved?

A. They are all proved by Allegation Medial.

Examples.

1. How much rye at 4*s*. per bushel, barley at 3*s*. per ıshel, and oats at 2*s*. per bushel, will make a mixture orth 2*s*. 6*d*. per bushel? Ans. 6 bushels of rye, 6 bush-s of barley, and 24 bushels of oats.

2. How many raisins of the sun at 7*d* per lb. and Malaga isins at 4*d* per lb. may be mixed together for 6*d* per lb. ns 2lb. of raisins of the Sun, and 1 lb. of Malaga raisins.

Note. Questions in this rule do frequently admit of an infinite .iety of answers and all in whole numbers as in the last exam-:s, where 2 and 1 do answer the question yet any other 2 num-rs will as truly do the like that are in the same proportion.

or 2 . 1 .
4	.	2
6	.	3
8	.	4
16	.	8
40	.	20 &c. without end.

3. A grocer would mix three sorts of sugar together, z. 1 sort of 10d. per lb. another at 7d. and another at . how much of each sort must he take, that the whole ixture may be sold for 8*d*. per lb.

lb.	d.	lb.	d.	lb.	d.

Ans. 3 at 10 : 2 at 7, and 2 at 6 per lb.

4. *A* malster hath several sorts of malt, viz. one sort at . per bushel, another at 3*s*. 6d. a third at 3*s*. and a fourth 2*s*. per bushel, and he is desirous to mix so much of each rt together, that the whole may be sold at 2*s*. 6d. per shel; I demand how much he must take of each sort?

Bush.	*s*.	B	*s*. *d*.	B.	*s*.	B.	*s*.

Ans. 6 at 4 : 6 at 3 6 : 6 at 3, and 36 at 2 per bushel.

5. *A* druggist hath several sorts of tea, viz one sort at *s* per lb. another at 11*s*. a third at 9*s*. and a fourth at per lb. I demand how much of each sort he must mix gether, that the whole quantity may be afforded at 10*s*. r lb.

	lb.	s.p.lb.
Ans.	2 at	12
	1 at	11
	1 at	9
	2 at	8

	lb.	s.p.lb.
2 *Ans.*	3 at	12
	2 at	11
	2 at	9
	3 at	8

	lb.	s.p.lb.
3. *Ans.*	1 at	12
	2 at	11
	3 at	9
	1 at	8

	lb.	s.	p.	lb.
4 *Ans.*	1 at	12		
	3 at	11		
	3 at	9		
	1 at	8		

	lb.	s.	p.	lb.
5 *Ans.*	3 at	12		
	1 at	11		
	3 at	9		
	2 at	8		

	lb.	s.	p.	lb.
6 *Ans.*	2 at	12		
	3 at	11		
	1 at	9		
	3 at	8		

7 Ans 3lb of each sort.

Note These seven answers arise from as many different ways of linking the rates of the simples together.

6. How much alloy must I mix with bullion of 10 oz. fine to abase the same to 8 oz. fine? *Ans.* to every 8 oz. of Bullion of 10 oz. fine, put 2 oz. of alloy, and that will abase it to 8 oz fine.

Case 2.

OF ALTERNATION PARTIAL.

Q. What do you observe in this second case?

A. When the rates of all the things, the quantity of but one of them, and the mean rate of the whole mixture are given to find the several quantities of the rest in proportion to the quantity given; take the difference between each price, and the mean rate, and place them alternately, as in case 1. Then say,

As the difference of the same name with the quantity
Is to the rest of the differences severally; [given,
So is the quantity given,
To the several quantities required.

Examples.

1. A man being determined to mix 10 bushels of wheat, at 4*s.* per bushel, with rye at 3*s.* with barley at 2*s.* and with oats at 1*s.* per bushel; I demand how much rye, barley and oats must be mixed with the 10 bushels of wheat, that the whole may be sold at 28*d.* per bushel?

	B.	p.	
1 Ans.	2	2	of Rye
	5	0	of Barley
	12	2	of Oats

	B.	
2 Ans.	40	of Rye
	50	of Barley
	20	of Oats

	B.	
Ans.	8	of Rye
	10	of Barley
	14	of Oats

	B.	
4 Ans.	10	of Rye
	14	of Barley
	14	of Oats

	B.	p.	
5 *Ans.*	12	2	of Rye
	5	0	of Barley
	17	2	of Oats

	B.	
6 Ans.	2	of Rye
	14	of Barley
	10	of Oats

7 Ans. { B. 50 of Rye, 70 of Barley, 20 of Oats }

2. A man being determined to mix 12 bushels of Oats at 18*d*. per bushel, with Barley at 2*s*. 6*d*. with Rye at 3*s*. and with Wheat at 4*s*. per bushel—I demand how much Barley, Rye and Wheat must be mixed with the 12 bushels of Oats, that it may bear the price of 22*d*. per bushel? Ans. 1 bushel of each sort.

3. A man being determined to mix 12 bushels of oats, at 18d per bushel, with barley at 2*s* 6*d* with rye at 3*s* and with wheat at 4*s* per bushel—Idemand how much barley, rye and wheat must be mixed with the 12 bushels of oats, that the whole may bear the price of 2*s* 9*d* per bushel?

1 Ans. { B. 60 of Barley, 60 of Rye, 12 of Wheat }

2 Ans. { B p. 2 $1\frac{9}{15}$ of Barley, 2 $1\frac{9}{15}$ of Rye, 12 0 of Wheat }

3 Ans. { B. 10 of Barley, 10 of Rye, 12 of Wheat }

4 Ans. { B 72 of Barley, 72 of Rye, 12 of Wheat }

5 Ans. { B. 2 of Barley, 12 of Rye, 10 of Wheat }

6 Ans. { B. 14 $1\frac{9}{15}$ of Barley, 2 $1\frac{9}{15}$ of Rye, 14 $1\frac{9}{15}$ of Wheat }

7 Answ. 12 Bushels of each sort.

4. *A* man being determined to mix 12 bushels of oats, at 18d per bushel, with barley 2*s*. 6*d*. with rye at 3*s*. and with wheat at 4*s*. per bushel—I demand how much barley, rye and wheat must be mixed with the 12 bushels of oats, that the whole quantity may bear the price of 3*s*. 6*d*. per bushel?

Answ. { B. 12 of Barley, 12 of Rye, 84 of Wheat }

5. *A* man intends to mix 28 bushels of oats, at 18*d* per bushel, with barley at 2*s*. 6*d*. with rye at 3*s*. and with wheat at 4*s*. *I would know how much barley, rye and wheat ought to be added to the 28 bushels of oats, that the whol*

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quantity may be afforded at 2*s.* per bushel? *Ans.* 4 bushels of each sort.

6. *A* Farmer would mix 27 bushels of peas, at 18*d* per bushel, with oats at 28*d* and with beans at 30*d* per bushel, that the whole quantity may bear the price of 20*d* per bushel—I demand how much oats and beans must be mixed with the 27 bushels of peas? *Ans.* 3 bushels of each sort.

Case 3.

OF ALTERNATION TOTAL.

Q. What do you observe in the third case?

A. When the rates of the several things, the quantity to be compounded, and the mean rate af the whole mixture are given, to find how much of each sort will make up the quantity: place the differences between the several prices, and the mean rate, alternately, as is case 1, then say,

As the sum of the differences,
Is to the whole composition;
So is the difference of each rate,
To the quantity of the same rate.

Examples.

1. *A* grocer had 4 sorts of sugar, viz. at 8*d* per lb. at 6*d*. at 4*d*. and at 2*d*. per lb. and he would have a composition of an Cwt. worth 5*d*. per lb. I demand how much of each sort must he take?

1 *Ans.*

lb.	d.p.lb
42	at 8
14	at 6
14	at 4
42	at 2
112	

2 *Ans.*

lb.	d.p.lb.
14	at 8
42	at 6
42	at 4
14	at 2
112	

3 *Ans.*

lb.	oz.	dr.	d.p.lb
28	0	0	at 8
37	5	$5\frac{4}{12}$	at 6
9	5	$5\frac{4}{12}$	at 4
37	5	$5\frac{4}{12}$	at 2
112	0	0	

4 *Ans.*

lb.	oz.	dr	d.p.lb.
37	5	$5\frac{4}{12}$	at 8
9	5	$5\frac{4}{12}$	at 6
37	5	$5\frac{4}{12}$	at 4
28	0	0	at 2
112	0	0	

5 *Ans.*

lb.	oz.	dr.		d.p.lb.
11	2	$3\frac{2}{10}$	at	8
44	12	$12\frac{8}{10}$	at	6
44	13	$12\frac{6}{10}$	at	4
11	3	$3\frac{2}{10}$	at	2
112	0	0		

6 *Ans.*

lb.		d.p.lb.
32	at	8
24	at	6
24	at	4
32	at	2
112		

7 *Answ.* 28 lb. of each sort.

2. *A* Vintner hath 4 sorts of Wine, viz. Canary at 10*s.* per gallon, Malaga at 8*s.* Rhenish at 6*s.* and Oporto at 4*s.* and he is minded to make a Composition of 60 gallons, worth 9*s.* per gallon—I demand how much of each sort he must have? *Ans.* 45 gallons of Canary, and 5 gals. of each other sort.

3. *A* Brewer hath 3 sorts of ale, to wit at 10*d.* at 8*d.* and at 6*d.* per gallon—and he would have a composition of 30 gallons, worth 7*d.* per gallon—I demand how much of each sort he must have?

Ans.

Gals.		d.p.gal.
5	at	10
5	at	8
20	at	6
30		

4. *A* Goldsmith hath several sorts of Gold, viz. some of 24 carrats fine, some of 22 carrats, and some of 18 carrats fine; and he would have compounded of these sorts the quantity of 60 oz. of 20 carrats fine—I demand how much of each sort he must take?

Ans.

Oz.		
12	at	24 Carrats fine.
12	at	22 Carrats fine.
36	at	18 Carrats fine.
60		

5. *A* Gold smith hath Gold of 3 sorts, viz. of 22 carrats, of 21 carrats, and of 20 carrats fine, and he would mix with these so much alloy, as that the quantity of 21 oz. may bear 18 carrats fine, I demand how much of each sort he must take and how much alloy? *Ans.* 6 oz. of each sort of Gold and 3 oz. of alloy.

6. *A* Druggist had 3 sorts of Drugs, one was worth 4*s*. per lb. another 5*s*. and another 8*s*. and out of these he made two parcels, one was 21 lb. at 6*s*. per lb. and the other 35 lb. at 7*s*. per lb. how much of every sort did he take for each parcel?

Ans.

lb.	s.p.lb.	lb.	s.p.lb.
6	at 4	5	at 4
6	at 5	5	at 5
9	at 8	25	at 8
21	at 6s.p.lb	35	at 7s. p.lb.

OF POSITION.

Q. WHAT is Position; or Negative Arithmetic?
A. It discovers the Truth by supposed Numbers.
Q. How many kinds of Position are there?
A. Two; Single and Double.

OF SINGLE POSITION.

Q. What is single Position?
A. It discovers the truth by only one supposed number.
Q. How is that supposed number used?
A. By working with it, as if it was the true number, in the same proportion as the question directs; and if the result be either too much or too little, the true number may be found out by the following Rule, viz.

As the Result of the Position,
Is to the Position:
So is the given number,
To the number required.

Q. How do you prove Position?
A. Position both Single and Double, is proved by adding the several sums required, or the several parts of the sum required together; and if that sum agrees with the given sum, it is right.

EXAMPLES.

1. Two men, A and B, having found a Bag of Money, disputed who should have it; A said the half, third and fourth of the money made 130*l* and if B could tell how much

was in it, he should have it all, otherwise he should have nothing; I demand how much was in the bag? Ans. 120*l.*

2. A, B and C, determined to buy together a certain quantity of timber, worth 36*l.* agree that B shall pay $\frac{1}{3}$ more than A, and C $\frac{1}{4}$ more than B—I demand how much each man must pay? Ans. A 9*l.* B 12*l.* C 15*l.*

3. A person having about him a certain number of Crowns, said if the half third and fourth of them were added together, they would make 65 Crowns—I demand how many he had? Ans. 60 Crowns.

4. A lent B a sum of money, to be paid at 4 payments; when 3 of them were made, and A came to demand the fourth, B. would give him no more, except he would tell him how much was paid already: A said the first payment was a fourth, the second a fifth, and the third a sixth of the sum first lent, and altogether made 74*l.* I demand the sum lent? Ans. 120*l.*

5. One man carrying a bag of money in his hand, another asked him how much was in it; he answered he could not tell; but the third, fourth and fifth of it made 94*l.* How much was in the bag? Ans. 120*l.*

6. I have delivered to a Banker a certain sum of money, to receive of him after the rate of 6*l.* per cent. per annum; and at the end of ten years he paid me 500*l.* for Principal and Interest together; I demand the sum delivered to him at first? Ans. 312*l.* 10*s.*

OF DOUBLE POSITION.

Q. What is Double Position.

A. It is that which discovers the true number sought, by making use of two supposed numbers.

Q. How are the supposed numbers used?

A. 1. By working with them as if they were the true numbers in the same proportion as the question directs.

2. The results or Errors must be placed against their Positions, or supposed Numbers, thus,

Pos.	*Err.*
40	28
36	19

3. Multiply them Cross-wise.

4. If the errors are alike, *i. e.* both greater, or both less than the given number, take their difference for a divisor, and the difference of the products for a dividend.

5. If the errors are unlike, take their sum for a divisor, and the sum of the products for a dividend; the quotient thence arising will be the answer.

Examples.

1. A, B and C, would divide 100*l* between them so as that B may have 3*l*. more than A, and C 4*l*. more than B; I demand how much each man must have? Ans. A 30*l* B 33*l*. C 37*l*.

2. A man lying at the point of death, said he had in a certain coffer 100*l* which he bequeathed to 3 of his friends after this manner: the first must have a certain portion, the second must have twice as much as the first, wanting 8*l* and the third must have three times as much as the first wanting 15*l*. I demand how much each man must have? Ans, the first 20*l* 10*s*. the second 33*l*. third 46*l* 10*s*.

3. A, B and C, built an House which cost 100*l*. of which A paid a certain sum, B paid 10*l*. more than A, and C paid as much as A and B—I demand each man's share in the charge? Ans. A 20*l*. B 30*l*. C 50*l*.

4. Three persons discoursed together concerning their ages; says A, I am 20 years of age; says, B I am as old as A, and half C; and says C, I am as old as you both; I demand the age of each person? Ans. A was 20, B 60, C 80 years of age.

5. A man lying at the point of death, left his 3 sons all his estate in money, viz. to F half wanting 50*l* to G 1 third, and to H the rest, which was 10*l* less than the share of G —I demand the sum left and each man's part? Ans. the sum left was 360*l* whereof F had 130*l*. G 120*l*. H 110*l*.

6. A certain man having drove his Swine to the market viz. Hogs, Sows and Pigs, received for them all 50*l*. being paid for every Hog 18*s*. for every Sow 16*s*. for every Pig 2*s*. There were as many Hogs as Sows, and for every Sow there were 3 Pigs—I demand how many there were of each sort? Ans. 25 Hogs, 25 Sows, 75 pigs.

7 A surly old fellow being demanded the ages of his four children, answered, you may go and look; but if you must needs know, my first son was born just 1 year after I was married to his mother, who after his birth, lived 5 years and then died in child-bed, with my second son; 4 years after that I married again, and within 2 years had my third and fourth sons at a birth: the sum of whose two ages is now equal to that of the eldest—I demand their several ages? Ans the first son was 22 years old, the second 17, the third 11, and the fourth 11 years old.

OF COMPARATIVE ARITHMETIC.

Q. WHAT Is Comparative Arithmetic ?

A. It is such as answers Questions by Numbers, having Relation one to another.

Q. Wherein does this Relation consist ?

A. It consists either in Quantity or Quality.

Q. What is Relation of Numbers in Quantity ?

A. It is the Respect that one number has to another.

Q. How many are the Numbers propounded ?

A. They are always two, the Antecedent and the Consequent.

Q. In what does relation of numbers in quantity consist?

A. It consists in the Difference, or else in the Rate or Reason that is found between the Terms propounded.

Note, The difference of any two numbers is the remainder; but the rate or reason is the quotient of the antecedent divided by the consequent.

Q. What is relation of numbers in quality or progression?

A. Progression or Proportion is the respect that the Reason of Numbers have one to another.

Q. How many must the terms be ?

A. Three or more, but never less, because less than 3 will not admit of a comparison of reasons or differences.

OF PROGRESSION.

Q. How many kinds of Progression are there ?

A. Two—Arithmetical and Geometrical.

OF ARITHMETICAL PROGRESSION.

Q. What is Arithmetical Progression ?

A. Arithmetical Progression is when several Numbers have equal differences—as 1, 2, 3, 4, differ by 1, or 2, 4, 6, 8, differ by 2.

Note 1, *If any number of terms differ by Arithmetical Progression, the sum of the two extremes will be equal to the Sum of any two means equally distant from the extremes. As in* 2, 4, 6, 8 : *where* $2+8$ *are* $=4+6=10$, *and so of any larger number of terms.*

2. *If the number of terms be odd, the middlemost supplies the place of two terms, as in* 1, 2, 3, ; *where* $1+3$ *are* $=2+2=4$.

CASE 1.

Q. What do you observe in this first case ?

A. When the two Extremes and the number of terms in any series of numbers in Arithmetical Progression are given and the sum of all the terms is required, then multiply the sum of the two extremes by half the number of terms. Or,

Multiply half the sums of the extremes by the whole number of terms, the product is the total of all the terms.

EXAMPLES.

1. How many Strokes does the Hammer of a Clock strike in 12 hours? Ans. 78.

2. A merchant hath sold 100 yds. of superfine cloth, viz. the 1st yard for 1*s*. the 2d 2*s*. the 3d for 3*s*. &c. I demand how much he received for the said cloth? Ans. 252*l*. 10*s*.

3. Bought 19 yards of Shalloon, and gave 1*d*. for the first yard, 3*d* for the second, 5*d*. for the third, &c. increasing 2*d*. every yard.—I demand what I gave for the 19 yards? Ans. 1*l*. 10*s*. 1*d*.

4. A Mercer sold 20 yards of silk, at 3*d*. for the first yard, 6*d*. for the 2d, 9*d*. for the 3d, &c. increasing 3*d* every yard—I demand what he sold the 20 yards for? Ans. 2*l*. 12*s*. 6*d*.

5. A Butcher bought 100 head of Cattle, viz. Oxen, and gave for the first Ox 1 Crown, for the second Ox 2 Crowns, for the third Ox 3 Crowns &c.—I demand what the Cattle cost him? Ans. 1262*l*. 10*s*.

6. Admit 100 stones were laid 2 yards distance from each other in a right line, and a basket placed 2 yards from the first stone; I demand how many miles a man shall go in gathering them singly into the basket? Answ. 11 miles, 3 furlongs, 180 yards.

7. A merchant sold 1000 yards of linen at 2 pins for the first yard, 4 for the second, and 6 for the third, &c. increasing 2 pins for every yard; I demand how much the linen produced, when the pins were afterwards sold at 12 for a farthing? also whether the said merchant gained or lost by the sale thereof, and how much, supposing the said linen to have been bought at 6*d* per yard?

Answ. { The linen produced 86*l* 17*s* 10*d*
The merchant gained 61 17 10

CASE 2.

Q. What do you observe in the second case?

A. When the two extremes, and the number of terms in any series of numbers in Arithmetical Progression, are given, and the common difference of all the terms in that series are required, then

Divide the difference between the two extremes, by the number of terms, less one; the quotient will be the common difference.

EXAMPLES.

1. There are 21 men, whose ages are equally distant from each other in Arithmetical Progressions the youngest is 20 years old, and the eldest is 60; I demand the common difference of their ages, and the age of each man? Answ. the common difference is two years therefore,

Years.

60 is the age of the first man
60—2=58 is the age of the second
58—2=56 is the age of the third
56—2=54 is the age of the fourth, &c.

2. A debt is to be discharged at 16 several payments in Arithmetical Proportion; the first payment is to be 14*l* the last 100*l*; what is the whole debt, and what must each payment be? Answ. the whole debt is 912*l*. the common difference is 5*l* 14*s* 8*d*. Therefore,

						14*l*	0*s*	0*d*	1st payment
14*l*	0*s*	0*d*	+	5*l*	14*s*	8*d*	= 19	14	8 2d
19	14	8	+	5	14	8	= 25	9	4 3d
25	9	4	+	5	14	8	= 31	4	0 4th, &c.

3. A man is to travel from York to a certain place in 12 days, and go but three miles the first day, increasing every day's journey by an equal excess so that the last day's journey may be 36 miles; what will each day's journey be, and how many miles is the place he goes to distant from York? Ans. the common difference is 3; therefore,

Miles.

3 is the first day's journey.
3+3= 6 is the second.
6+3= 9 is the third.
9+3=12 is the fourth &c.
The whole distance is 234 miles.

4. A running footman on a wager, is to travel from London, northward, as follows; that is to say, he is to go 4 miles the first day, and 40 miles the last day, and to go the whole journey in 10 days, increasing every day's journey by an equal excess: I demand the number of miles he travelled each day, and the length of the whole journey? Ans. the common difference is 4; therefore,

Miles.
4 is the first day's journey.
4+4= 8 is the second.
8+4=12 is the third, &c.
The whole journey is 220 miles.

OF GEOMETRICAL PROGRESSION.

Q. What is Geometrical Progression?

A. When any rank or series of numbers increases by one common multiplier, or decreases by one common divisor, those numbers are continued in Geometrical Progression; as 3, 6, 12, 24 increase by the multiplier 2—and 24, 12, 6, 3, decrease by the divisor 2.

Note 1. *If any number of Terms be continued in Geometrical Progression, the product of the two extremes will be equal to the product of any two means equally distant from the extremes, as in* 3, 6, 12, 24; *where* 3×24, *are*=6×12=72; *and so of any larger number of Terms.*

2. *If the number of terms be odd, the middlemost supplies the place of two terms; as in* 3, 6, 12; *where* 3×12 *are* =6×6=36.

3. *The common multiplier, and the common divisor, are called Ratios.*

Q. How is the sum of any series in Geometrical Progression obtained?

A. 1. When all the terms alone are given then from the product of the second and last terms, subtract the square of the first term; that remainder being divided by the second term less the first, will give the sum of all the terms.

2. When the two extremes and the ratio are only given, then multiply the last term into the ratio, and from that product subtract the first term: that remainder divide by the ratio less an unit or 1, the quotient is the sum of all the terms.

Note, 1. As the last term in a long series of numbers is very tedious to come at by continual multiplication; it would be necessary for the readier finding it out, to have a series of numbers in Arithmetical Proportion, called indices, beginning with an unit whose common difference is one; also whatsoever number of indices you make choice of, let as many numbers (in such Geometrical Proportion as are given in the question) be placed under them.

Thus, { 1, 2, 3, 4, 5, 6, 7, *Indices.* } *Proportion.*
{ 2, 4, 8, 16, 32, 64, 128, *Numbers in Geometrical*

2. But if the first term in Geometrical Proportion be different from the ratio, the indices must begin with a cypher.

Thus, { 0, 1, 2, 3, 4, 5, 6, *Indices.*
{ 1, 2, 4, 8, 16, 32, 64, *Numbers in Geometrical Proportion.*

3. When the indices begin with a cypher, the sum of the indices made choice of must always be one less than the number of terms given in the question: because 1 in the indices stands over the second term, and 2 in the indices stands over the third term, &c.

4. Add any two of these indices together, and that sum will directly correspond with the product of their respective terms.

5. By the help of these indices, and a few of the first terms, in any series of Geometrical Progression, any term whose distance from the first term is assigned, though it were never so far, may speedily be obtained, without producing all the terms.

EXAMPLES.

1. A man bought a horse, and by agreement was to give a farthing for the first nail, two for the second, four for the third, &c there were 4 shoes and 8 nails in each shoe—I demand what the horse was worth at that rate? Ans. 4473924*l.* 5*s.* 3*d.* 3 qrs.

2. A Merchant sold 15 yards of sattin, the first yard for 1*s.* the second for 2*s.* the third for 4*s.* the 4th for 8*s.* &c. I demand the price of the 15 yards? Ans. 1638*l* 7*s.*

3. A Draper sold 20 yards of superfine Cloth, the first yard for 3*d.* the second for 9*d.* the 3d. for 27*d.* &c. in tripple Proportion Geometrical—I demand the price of the Cloth? Ans. 2179240211 10*s.*

4. A Goldsmith sold 1 lb. of gold, at a farthing for the first ounce, a penny for the second, 4*d.* for the third, &c. in quadruple Proportion Geometrical—I demand what he sold the whole for; also how much he gained by the sale thereof, supposing he gave for it 4*l.* per ounce?

Ans. { He sold it for *L* 5825 8*s.* 5*d.* 1 qr.
{ And gained 5777 8 5 1

5. A crafty servant agreed with a farmer (ignorant in numbers) to serve him 12 years, and to have nothing for his service but the produce of a wheat-corn for the first year and that product to be sowed for the second year; and so on from year to year, until the end of the said time—I demand the worth of the whole produce, supposing the increase to be but in a tenfold proportion, and sold out at 4*s.* per bushel? Ans. 452112*l* 4*s.* rejecting remainders.

Note 1. 7680 wheat or barley-corns are supposed to make a *pint and 64 pints* a bushel.

2. If the first term in any series be either greater or less than the ratio (except unity) then multiply any two terms together and their product divide by the first terms—that quotient will exactly correspond with the sum of their indices.

6. A thresher worked 20 days at a farmer's and received for the first day's work 4 barley-corns, for the second 12 barley-corns, for the third 36 barley-corns, and so on in triple proportion geometrical—I demand what the 20 days labour came to, supposing the whole quantity to be sold for 2s. 6d. per bushel? Ans. 1773*l.* 7s. 6d. rejecting remainders.

7. A merchant sold 30 yards of fine velvet, trimmed with gold very curiously, at 2 pins for the first yard, 6 pins for the second, 18 pins for the third, &c. in triple proportion geometrical—I demand how much the velvet produced, when the pins were afterwards sold at 100 for a farthing; also whether the said merchant gained or lost by the sale thereof, and how much, supposing the said velvet to have been bought at 50*l.* per yard?

Answ. { The velvet produced 2144699292*l.* 13*s.* 0½
{ The merchant gained 2144697792*l.* 13 0½

OF PERMUTATION.

Q. WHAT is Permutation?

A. Changing the Order of things.

Q. How do you find all the variations any number of things is capable of going through?

A. Multiply all the given terms one into another continually; the last product is the number of changes required

Examples.

1. I demand how many changes may be rung upon 12 bells—and also how long they would be in ringing but once over, supposing 24 changes might be rung in one minute, and the year to contain 365 days, 6 hours? Ans. the number of changes is 479001600, and the time is 37 years, 49 weeks, 2 days, 18 hours.

2. Seven gentlemen who were travelling met together by chance at a certain inn upon the road, where they were so well pleased with their host, and each other's company, that in a frolick they offered him 30*l.* to stay at that place so long as they, together with him, could sit every day at

dinner in a different order: The host thinking that they could not sit in many different positions, because they were but few of them, and that himself would mak no considerable alteration; he being but one, imagined that he should make a good bargain, and readily, (for the sake of a good dinner, and better company) entered into an agreement with them, and so made himself the eighth person: I demand how long they staid at the said inn, and how many different positions they sat in? Ans. the number of positions were 40320: and the time that they staid was 110 years, 142 days; allowing the year to consist of 365 days, 6 hours.

Note. There is one thing in progression, and in varying the order of things, which is well worth our observation; and that is, the power of numbers, which is surprisingly great, and beyond common belief; and is no ways conceivable by a common practitioner, hardly by a very good artist; it being (in appearance) not so much against reason as above it. The first example in geometrical progression discovers what a prodigious sum of money a horse sold after that manner would produce, viz. no less than four million, four hundred and seventy three thousand nine hundred and twenty four pounds; whereas if the same horse had been sold at the same rate, and but a fourth part of the nails he would have brought to his owner no more than 5s. 3d. 3-4. The second example in Permutation does likewise discover the impossibility of the innkeepers's performing his promise: and in both, the simplicity of two men, who, thinking they have got very good bargains, do, instead thereof, find themselves severe sufferers. And altho' at the first appearance each question seems to produce but a mere trifle; yet upon a mature consideration, there would not be found a man in the kingdom able to purchase the one, or long-lived enough to stand the agreement with the other. Hence observe the great possibility of a man's being imposed on in this way by sharpers, without a careful examination into the affair, before any contract is made.

THE

SCHOOLMASTER'S

ASSISTANT.

PART II.

OF VULGAR FRACTIONS.

OF FRACTIONS IN GENERAL.

Q. WHAT is a Fraction?

A. It is a broken Number, and signifies the Part or Parts of a whole Number.

Q. How many kinds of Fractions are there?

A. Two, Vulgar and Decimal.

OF NOTATION OF VULGAR FRACTIONS.

Q. What is a Vulgar Fraction?

A. Any two numbers placed thus $\frac{7}{8}$ make a Vulgar Fraction.

Q. What is the upper number of such a Fraction called?

A. It is called Numerator, and is the Remainder after Division.

Q. What is the lower number called?

A. It is called Denominator, and denotes any Whole divided into Parts: and is the Divisor in Division.

Q. How many sorts of Vulgar Fractions are there?

A. Three: Proper, Improper, and Compound.

Q. What is a Proper Fraction?

A. When the Numerator is less than the Denominator, as $\frac{7}{9}$.

Q. How far may a proper fraction be expressed?

A. Without end: as $\frac{1}{2}$ may be called $\frac{2}{4}$ or $\frac{3}{6}$ or $\frac{4}{8}$, &c. but the lowest Term $\frac{1}{2}$ is always desired.

Q. What is an Improper Fraction?

A. When the Numerator is greater than the Denominator, as $\frac{9}{7}$.

Q. What is a Compound Fraction?

A. It is a Fraction of a Fraction, as $\frac{1}{2}$ of $\frac{2}{3}$, &c.

OF REDUCTION OF VULGAR FRACTIONS.

CASE 1.

Q. HOW are Vulgar Fractions reduced to a common Denominator

A. 1. Multiply each Numerator into all the denominators *but its own*, for a new Numerator.

2. Multiply all the Denominators for a common Denominator.

EXAMPLES.

1. Reduce $\frac{3}{8}$&$\frac{5}{8}$ to a common Denominator. Facit $\frac{24}{48}$&$\frac{30}{48}$.

2. Reduce $\frac{7}{8}$, $\frac{9}{10}$ and $\frac{11}{12}$ to a common Denominator. Facit $\frac{840}{960}$, $\frac{864}{960}$, and $\frac{880}{960}$.

3. Reduce $\frac{6}{10}$, $\frac{4}{8}$, $\frac{1}{5}$, and $\frac{6}{7}$ to a common Denominator. Facit $\frac{3024}{5040}$, $\frac{2520}{5040}$, $\frac{560}{5040}$, and $\frac{4320}{5040}$.

4. Reduce $\frac{4}{9}$, $\frac{7}{11}$, $\frac{6}{7}$, and $\frac{1}{2}$ to a common Denominator. Facit $\frac{616}{1386}$, $\frac{882}{1386}$, $\frac{1188}{1386}$, and $\frac{693}{1386}$.

5. Reduce $\frac{6}{9}$, $\frac{2}{7}$, $\frac{1}{3}$, and $\frac{7}{8}$ to a common Denominator. Facit $\frac{1008}{1512}$, $\frac{432}{1512}$, $\frac{504}{1512}$, and $\frac{1323}{1512}$.

6. Reduce $\frac{4}{5}$, $\frac{1}{2}$, $\frac{5}{6}$, and $\frac{3}{8}$ to a eommon Denominator. Facit $\frac{384}{480}$, $\frac{240}{480}$, $\frac{400}{480}$, and $\frac{120}{480}$.

CASE 2.

Q. How do you reduce a Vulgar Fraction to its lowest Terms?

A. Find a common Measure by dividing the lower Term by the upper: and that Divisor by the remainder following, till nothing remains; the last Divisor is the common Measure.

2. Divide both parts of the fraction by the common Measure, and the quotients will make the Fraction required.

Note 1. If the common Measure happens to be 1, the given Fraction is already in its lowest Terms.

2. When a Fraction hath Cyphers at the right hand, it may be abbreviated by cutting them off, thus $\frac{7|0}{9|0}$

3. This Case will prove Case 1.

EXAMPLES.

1. Reduce $\frac{48}{56}$ to its lowest Terms. Facit $\frac{6}{7}$.
2. Reduce $\frac{72}{94}$ to its lowest Terms. Facit $\frac{36}{47}$.
3. Reduce $\frac{84}{170}$ to its lowest Terms. Facit $\frac{42}{85}$.
4. Reduce $\frac{60}{125}$ to its lowest Terms. Facit $\frac{12}{25}$.
5. Reduce $\frac{182}{196}$ to its lowest Terms. Facit $\frac{13}{14}$.
6. Reduce $\frac{468}{1184}$ to its lowest Terms. Facit $\frac{117}{296}$.

CASE 3.

Q. What is a mixt number?

A. It is composed of a whole Numb. and a fraction, thus, $7\frac{3}{4}$

Q. How is a mixt Numb. reduced to an improper fraction?

A. 1. Multiply the whole Number into the Denominator of the Fraction.

2. To the Product, add the Numerator, for a new numerator.

3. Let its Denominator, be the Denominator given.

Note. To express a whole Number Fraction-wise, put 1 for its Denominator.

EXAMPLES.

1. Reduce $12\frac{15}{17}$ to an improper Fraction. Facit $\frac{219}{17}$.
2. Reduce $19\frac{12}{19}$ to an improper Fraction. Facit $\frac{374}{19}$.
3. Reduce $16\frac{18}{100}$ to an improper Fraction. Facit $\frac{1618}{100}$.
4. Reduce $12\frac{19}{56}$ to an improper Fraction. Facit $\frac{691}{56}$.
5. Reduce $100\frac{19}{59}$ to an improper Fraction. Facit $\frac{5919}{59}$.
6. Reduce $79\frac{12}{19}$ to an improper Fraction. Facit $\frac{1513}{19}$.

CASE 4.

Q. How is an Improper Fraction reduced to its proper Terms.

A. Divide the upper Term by the lower.

Note, This case and case 3, prove each other.

EXAMPLES.

1. Reduce $\frac{219}{17}$ to its proper Terms. Facit $12\frac{15}{17}$.
2. Reduce $\frac{141}{17}$ to its proper Terms. Facit $8\frac{5}{17}$.
3. Reduce $\frac{126}{49}$ to its proper Terms. Facit $2\frac{30}{49}$.
4. Reduce $\frac{961}{17}$ to its proper Terms. Facit $56\frac{9}{17}$.
5. Reduce $\frac{15}{7}$ to its proper Terms. Facit $1\frac{8}{7}$.
6. Reduce $\frac{24}{7}$ to its proper Terms. Facit $3\frac{3}{7}$.

CASE 5.

Q. How do you reduce a Compound Fraction to a single one?

A. 1. Multiply all the numerators for a new numerator.

2. Multiply all the denominators for a new denominator.

EXAMPLES.

1. Reduce $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ to a single Fraction. Facit $\frac{6}{24}$.
2. Reduce $\frac{7}{8}$ of $\frac{4}{6}$ of $\frac{9}{10}$ to a single Fraction. Facit $\frac{252}{480}$.
3. Reduce $\frac{4}{14}$ of $\frac{5}{6}$ of $\frac{1}{2}$ to a single Fraction. Facit $\frac{60}{168}$.
4. Reduce $\frac{5}{9}$ of $\frac{4}{8}$ of $\frac{3}{4}$ to a single Fraction. Facit $\frac{60}{288}$.
5. Reduce $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$ to a single Fraction. Facit $\frac{24}{60}$.
6. Reduce $\frac{1}{2}$ of $\frac{8}{9}$ of $\frac{6}{7}$ to a single Fraction. Facit $\frac{48}{126}$.

CASE 6.

Q. How do you reduce the Fraction of 1 denomination to the fraction of another, but greater, retaining the same value?

A. 1. Reduce the given fraction to a compound fraction by comparing it with all the denominations between it, and that denomination, which you would reduce it to.

2. Reduce that compound fraction to a single one, by Case 5.

EXAMPLES.

1. Reduce $\frac{5}{8}$ of a Penny to the Fraction of a Pound. *Facit* $\frac{5}{1440}$.

2. Reduce $\frac{1}{2}$ of a farthing to the fraction of a shilling. Facit $\frac{1}{96}$ s.

3. Reduce $\frac{8}{9}$ of an Ounce Troy, to the Fraction of a Pound. Facit $\frac{8}{108}$ lb.

4. Reduce $\frac{6}{7}$ of a Pound Avoirdupois to the fraction of a Cwt. Facit $\frac{6}{784}$ Cwt.

5. Reduce $\frac{9}{10}$ of a pint of Wine to the fraction of a hhd. Facit $\frac{9}{6552}$ hhd.

Case 7.

Q. How do you reduce the fraction of one denomination to the fraction of another, but less, retaining the same value?

A. Multiply the given numerator, by the parts of the denominations between it, and that denomination you would reduce the fraction to, for a new numerator and place it over the given denominator.

Note. This case and case 6, prove each other.

Examples.

1. Reduce $\frac{5}{1440}$ of a pound to the fraction of a penny. Facit $\frac{1200}{1440}=\frac{5}{6}$d.

2. Reduce $\frac{1}{96}$ of a shil. to the fraction of a farthing. Fa. $\frac{1}{8}$qr.

3. Reduce $\frac{8}{108}$ lb. Troy to the fraction of an oz. Fa. $\frac{8}{9}$ oz.

4. Reduce $\frac{6}{784}$ of a cwt. to the fraction of a lb. Facit $\frac{6}{7}$ lb.

5. Reduce $\frac{9}{6552}$ of a hhd. of wine to the fraction of a pint. Facit $\frac{9}{13}$ pint.

Case 8.

Q. How do you reduce Vulgar Fractions from one Denomination to another of the same Value, having the Numerator of the required fraction given.

A. As the Numerator of the given Fraction,
Is to its Denominator:
So is the Numerator of the intended Fraction,
To its Denominator.

Examples.

1. Reduce $\frac{3}{4}$ to a fraction of the same value, whose numerator shall be 15. Facit $\frac{15}{20}=\frac{3}{4}$.

2. Reduce $\frac{7}{8}$ to a fraction of the same value, whose numerator shall be 42. Facit $\frac{42}{48}$.

3. Reduce $\frac{3}{4}$ to a fraction of the same value, whose numerator shall be 34. Facit $\frac{34}{45}$ $\frac{1}{3}$.

4. Reduce $\frac{5}{9}$ to a fraction of the same value, whose numerator shall be 73. Facit $\frac{73}{131}$ $\frac{2}{5}$.

Note, From cases 8 and 9, there arises a new fraction, which may not improperly be called a mixt fraction.

Case 9.

Q. How do you reduce Vulgar Fractions from one denomination to another of the same value, having the denominator of the required fraction given?

A. As the Denominator of the given Fraction,
Is to the Numerator:
So is the Denominator of the intended fraction,
To its Numerator.

Note. This case and case 8 prove each other.

Examples.

1. Reduce $\frac{3}{4}$ to a fraction of the same value, whose denominator shall be 20. Facit $\frac{15}{20}=\frac{3}{4}$.

2. Reduce $\frac{7}{8}$ to a fraction of the same value, whose denominator shall be 49. Facit $\frac{42}{48}$ $\frac{7}{8}$.

3. Reduce $\frac{3}{4}$ to a fraction of the same value, whose denominator shall be 46. Facit $\frac{34}{46}$ $\frac{2}{4}$.

4. Reduce $\frac{5}{9}$ to a fraction of the same value, whose denominator shall be 131 $\frac{2}{5}$. Facit $\frac{73}{131}$ $\frac{2}{5}$.

Case 10.

Q. How is a mixt fraction reduced to a single fraction?

A. 1. When the numerator is the integral part: then

(1) Multiply it by the denominator of the fractional part, and to that product add the numerator of the fractional part, for a new numerator.

(2) Multiply the denominator of the fraction by the denominator of the fractional part of the numerator, for a new denominator.

Note, This proves case 9.

Examples.

1. Reduce $\frac{42}{49}$ $\frac{7}{8}$ to a simple fraction. Facit $\frac{7}{8}$.
2. Reduce $\frac{34}{46}$ $\frac{1}{2}$ to a simple fraction. Facit $\frac{3}{4}$.
3. Reduce $\frac{17}{43}$ $\frac{4}{9}$ to a simple fraction. Facit $\frac{15}{387}$.

2. When the denominator is the integral part: then,

(1) Multiply it by the denominator of the fractional part and to that product add the numerator of the fractional part, for a new denominator.

(2) Multiply the numerator of the fraction by the denominator of the fractional part, for a new numerator.

Note, This proves case 8.

Examples.

1. Reduce $\frac{73}{131}$ $\frac{2}{5}$ to a simple fraction. Facit $\frac{365}{657}=\frac{5}{9}$.
2. Reduce $\frac{41}{73}$ $\frac{1}{4}$ to a simple fraction. Facit $\frac{164}{292}$.
3. Reduce $\frac{7}{19}$ $\frac{3}{5}$ to a simple fraction. Facit $\frac{35}{95}=\frac{7}{19}$

CASE 11.

Q. How do you find the proper quantity of a fraction in the known parts of an integer ?

A. Multiply the numerator by the common parts of the integer, and divide by the denominator.

EXAMPLES.

1. Reduce $\frac{2}{3}$ of a pound sterling to its proper quantity. Facit 13*s.* 4*d.*

2. Reduce $\frac{18}{43}$ of a shil. to its proper quantity. Fa. 5*d.* $\frac{1}{43}$.

3. Reduce $\frac{6}{7}$ of 5*l.* 9*s.* to its proper quantity. Facit 4*l.* 13*s.* 5*d* $\frac{1}{7}$.

4. Reduce $\frac{12}{17}$ of a lb.troy to its proper quantity. Facit 9oz.

5. Reduce $\frac{12}{78}$ of a ton weight to its proper quantity. Facit 3 C. 0 qr. 8lb. 9 oz. 13 dr. $\frac{42}{78}$.

6. Reduce $\frac{5}{9}$ of a lb. of Avoirdupois to its proper quantity. Facit 8 oz. 14 dr. $\frac{2}{9}$.

7. Reduce $\frac{9}{11}$ of 10 C. 1 qr. 12 lb. to its proper quantity. Facit 8C. 1 qr. 25 lb. 1 oz 7 dr. $\frac{3}{11}$.

8. Reduce $\frac{4}{7}$ of a mile to its proper quantity. Facit 4 fur. 125 yds. 2 feet. 1 in. 2b.c $\frac{4}{7}$.

9. Reduce $\frac{9}{10}$ of a yard to its proper quantity. Facit 2 feet, 8 inches. 1 b. c. $\frac{5}{10}$.

10. Reduce $\frac{4}{5}$ of an Ell English to its proper quantity, Facit 1 yd.

11. Reduce $\frac{7}{16}$ of an Acre to its proper quantity. Facit 1 rood, 30 perches.

12. Reduce $\frac{4}{9}$ of a tun of wine to its proper quantity. Facit 1 hhd. 49 gallons.

13. Reduce $\frac{7}{8}$ of a barrel of beer to its proper quantity. Facit 31 gals. $\frac{1}{2}$.

14. Reduce $\frac{3}{8}$ of a chaldron of coals to its proper quantity. Facit 13 bush. $\frac{1}{2}$.

15. Reduce $\frac{2}{7}$ of a qr. of corn to its proper quantity. Facit 2 bush. 1 peck $\frac{1}{7}$.

16. Reduce $\frac{7}{13}$ of a day natural to its proper quantity. Facit 12 hrs. 55 min. 23 sec. $\frac{7}{13}$.

17. Reduce $\frac{4}{5}$ of a month to its proper quantity. Facit 3 weeks, 1 day, 9 hours, 36 min.

18. What is the proper quantity of $\frac{7}{8}$ of a yd. of cloth ? Answ. 3 qrs. 2 na.

19. What is the proper quantity of $\frac{2}{9}$ of a hhd. of beer ? Answ. 12 gals.

20. *What is* the proper quantity of $\frac{3}{16}$ of a barrel of Ale ? *Answ. 6 gals.*

Case 12.

Q. How do you reduce any given quantity to the fraction of any greater denomination of the same kind?

A. 1. Reduce the given quantity to the lowest Term mentioned for a Numerator.

2. Reduce the integral Part of the same Term for a Denominator, and that will be the fraction required.

Note, 1. If there be a fraction given with said quantity, let it be put to the numerator of the fraction required.

2. Cases 11 and 12 prove each other.

Examples.

1. Reduce 13*s*. 4*d*. to the fraction of a pound sterling. Facit $\frac{160}{240}=\frac{2}{3}l$.

2. Reduce 5*d* $\frac{1}{4}\frac{1}{3}$ to the fraction of a shilling. Facit $\frac{18}{43}$.

3. What part of 5*l*. 9*s*. is 4*l*. 13*s*. 5*d*. $\frac{1}{7}$? Ans. $\frac{6}{7}$.

4. Reduce 9 oz. Troy to the fraction of a lb. Facit $\frac{9}{12}=\frac{3}{4}$lb

5. Reduce 3 C. 0 qr. 8 lb. 9 oz. 13 dr. $\frac{42}{78}$ to the fraction of a ton. Facit $\frac{12}{78}$ ton.

6. Reduce 8 oz. 14 dr. $\frac{3}{5}$ to the fraction of a lb. Avoirdupois. Facit $\frac{5}{9}$ lb.

7. What part of 10 C. 1 qr. 12 lb. is 8 C. 1 qr. 25 lb. 1 oz. 7 dr. $\frac{3}{11}$? Ans. $\frac{9}{11}$.

8. Reduce 4 fur. 125 yds. 2 feet, 1 in. 2 b. c. $\frac{1}{7}$ to the fraction of a mile. Facit $\frac{4}{7}$ mile.

9. Reduce 2 feet 8 in. 1 b. c. $\frac{2}{10}$ to the fraction of a yd. Facit $\frac{3}{10}$ yard.

10. Reduce 1 yd. to the fraction of an ell. Facit $\frac{4}{5}$ ell.

11. Reduce 1 rood 30 poles to the fraction of an Acre. Facit $\frac{7}{10}$ Acre.

12. Reduce 1 hhd. 49 gals. of wine to the fraction of a tun. Facit $\frac{4}{9}$ tun.

13. Reduce 31 gals. $\frac{1}{2}$ of beer to the fraction of a barrel. Facit $\frac{7}{8}$ barrel.

14. Reduce 13 bush. $\frac{1}{2}$ of Coals to the fraction of a chaldron. Facit $\frac{3}{8}$ chaldron.

15. Reduce 2 bush. 1 peck $\frac{1}{7}$ of Corn to the fraction of a quarter. Facit $\frac{2}{7}$ quarter.

16. Reduce 12 hrs. 55 min. 23 sec. $\frac{1}{13}$ to the fraction of a day natural. Facit $\frac{7}{13}$ day.

17. Reduce 3 w. 1 d. 9 hrs. 36 min. to the fraction of a *month*. Facit $\frac{4}{5}$ month.

18. Reduce 3 qrs. 3 na. to the fraction of a yard. *Facit* $\frac{7}{8}$*yd.*

19. Reduce 12 gals. of Beer to the fraction of a hhd. Facit $\frac{4}{18}$.

20. Reduce 6 gals. of Ale to the fraction of a barrel. Facit $\frac{3}{10}$ bar.

21. Reduce 13 hrs. 30 min. to the fraction of a day. Facit $1\frac{810}{4402} = \frac{9}{18}$.

OF ADDITION OF VULGAR FRACTIONS.

Q. HOW are Vulgar Fractions added together?

A. 1. Reduce the given Fractions to a common Denominator.

2. Add all the Numerators together for a new Numerator; under which subscribe the common Denominator.

Note. This rule is proved by substraction, when two fractions only are given.

EXAMPLES.

1. Add $\frac{1}{5}$ and $\frac{7}{8}$ together - - Facit $1\frac{6}{10}$
2. Add $\frac{7}{10}$ and $1\frac{1}{12}$ and $\frac{4}{9}$ together - Facit $2\frac{668}{1080}$
3. Add 19 and $7\frac{1}{3}$ of $\frac{2}{3}$ together - Facit $26\frac{2}{6}$
4. Add $\frac{1}{2}$ of $\frac{7}{8}$ and $\frac{2}{3}$ of $\frac{19}{20}$ together - Facit $1\frac{68}{160}$
5. Add $\frac{1}{3}$ of 95 and $\frac{7}{8}$ of 14 together Facit $43\frac{22}{24}$
6. Add $\frac{2}{3}$ and $17\frac{1}{2}$ together - Facit $18\frac{1}{6}$
7. Add $12\frac{1}{2}$ and $3\frac{2}{3}$ and $4\frac{3}{4}$ together Facit $20\frac{22}{24}$
8. Add $6.\frac{7}{8}$ of $\frac{9}{10}$ and $\frac{4}{7}$ of $\frac{1}{2}$ and $7\frac{1}{2}$ toge'r. Facit $14\frac{12884}{22440}$

Note. In order to find the following facits, the fractions given must be reduced to their proper quantities by case 11, in reduction, and then added, as in addition of whole numbers.

9. Add $\frac{7}{8}$ of a pound to $\frac{3}{4}$ of a shilling. Facit 18s. 3d.

10. Add $\frac{3}{4}$ of a penny to $\frac{1}{9}$ of a pound. Facit 2s. 3d. 1qr. $\frac{6}{9}$

11. Add $\frac{1}{2}$ of a Pound Troy to $\frac{7}{12}$ of an oz. Facit 6 oz. 11 dwts. 16 grs.

12. Add $\frac{4}{7}$ of a ton to $\frac{9}{10}$ of Cwt. Facit 12 C. 1 qr. 8 lb. 12 oz. 12 dr. $\frac{8}{10}$.

13. Add $\frac{3}{4}$ of a mile to $\frac{7}{10}$ of a furlong. Fa. 6 fur. 28 po.

14. Add $\frac{1}{3}$ of yd. to $\frac{2}{3}$ of a foot. Facit 2 feet 2 in.

15. Add $\frac{1}{3}$ of a day to $\frac{1}{2}$ of an hour. Facit 8 hrs. 30 min.

16. Add $\frac{4}{9}$ of a chal. to $\frac{1}{7}$ of a bush. Fa. 16 bush. 3 pecks $\frac{1}{4}$.

17. Add $\frac{1}{5}$ of a week, $\frac{1}{4}$ of a day, and $\frac{1}{2}$ of an hour together. Facit 2 days, 14 hours $\frac{1}{2}$.

18. *Add* $\frac{2}{3}$ of a yard, $\frac{3}{4}$ of a foot, and $\frac{7}{8}$ of a mile together. *Facit 1540 yards, 2 feet, 9 inches.*

OF SUBTRACTION OF VULGAR FRACTIONS.

Q. HOW are Vulgar Fractions subtracted?

A. 1. Reduce the given Fractions to a common Denominator.

2. Subtract the lesser numerator from the greater, and place that difference over the common denominator.

3. When the lower fraction is greater than the upper, subtract the numerator of the lower fraction from the denominator, and to that difference add the upper numerator, carrying 1 to the units place of the lower whole number.

Note, This rule is proved by addition.

EXAMPLES.

1. From $\frac{111}{112}$ take $\frac{3}{4}$ - - - - - - Facit $\frac{102}{448}$
2. From $\frac{97}{100}$ take $\frac{3}{7}$ - - - - - - Facit $\frac{379}{700}$
3. From $96\frac{1}{3}$ take $14\frac{3}{7}$ - - - - - Facit $81\frac{19}{21}$
4. From 96 take $\frac{3}{5}$ - - - - - - Facit $95\frac{2}{5}$
5. From $\frac{1}{7}$ of 76 take $\frac{3}{4}$ of 21 - Facit $9\frac{7}{12}$
6. From $\frac{109}{110}$ take $\frac{1}{3}$ of $\frac{2}{3}$ of $\frac{3}{4}$ - Facit $\frac{1956}{2640}$
7. From $71\frac{1}{2}$ take $\frac{17}{15}$ - - - - - - Facit $70\frac{23}{30}$
8. From $14\frac{1}{4}$ take $\frac{2}{3}$ of 19 - - - Facit $1\frac{7}{12}$

Note. In order to find the following facits, the fractions given must be reduced to their proper quantities by case 11, in reduction, and then subtracted, as in subtraction of whole numbers.

9. From $\frac{1}{2}$ of a pound take $\frac{3}{4}$ of a shilling. Facit 9s 3d.

10. From $\frac{1}{2}$ of a shilling take $\frac{3}{4}$ of a penny. Facit $5d\frac{1}{4}$.

11. From $\frac{3}{5}$ of an oz take $\frac{7}{8}$ of a dwt. Facit 11. dwt 3 gr.

12. From $\frac{1}{2}$ of an C wt take $\frac{7}{12}$ of a pound. Facit 1 qr 27 lb 6 oz 10 dr $\frac{8}{12}$.

13. From $\frac{2}{3}$ of a league take $\frac{7}{10}$ of a mile. Facit 1 mile 2 fur. 16 poles.

14. From 1 ell take $\frac{7}{10}$ of a qr. Facit 1 yd 0 qr 1 na $\frac{2}{10}$.

15. From $\frac{3}{4}$ of a hhd of beer take 1 gal. Facit 12 $\frac{1}{2}$ gal.

16. From $\frac{4}{5}$ of a chaldron take $\frac{2}{3}$ of a bushel. Facit 17 bushels, 1 peck $\frac{1}{3}$.

17. From 7 weeks take 9 days $\frac{7}{10}$ Facit 5 weeks, 4 days. 7 hours, 12 minutes.

18. From 4 days, 7 hours $\frac{1}{2}$, take 1 day, 9 hours $\frac{3}{12}$. Facit. *2 days, 22 hours,* $\frac{1}{3}$.

OF MULTIPLICATION OF VULGAR FRACTIONS.

Q. HOW are Vulgar Fractions multiplied?

A. 1. Prepare the given numbers (if need be) by the rules of reduction.

2. Multiply all the given numerators for a new numerator, and all the denominators for a new denominator.

Note. When any number, either whole or mixt, is multiplied by a fraction, the product is always less than the multiplicand, in the same proportion as the multiplying fraction is less than 1 or an unit.

EXAMPLES.

1. Multiply $\frac{3}{7}$ - - by $\frac{3}{11}$ - - - *Facit* $\frac{9}{77}$
2. Multiply $\frac{4}{9}$ - - by $\frac{7}{9}$ - - - *Facit* $\frac{28}{72}$
3. Multiply $\frac{1}{3}$ of $\frac{4}{5}$ - by $\frac{7}{10}$ of $1\frac{1}{2}$ - *Facit* $\frac{308}{1800}$
4. Multiply $7\frac{1}{4}$ - - by $8\frac{1}{2}$ - - - *Facit* $61\frac{5}{8}$
5. Multiply $4\frac{1}{2}$ - - by $\frac{1}{8}$ - - - *Facit* $\frac{9}{16}$
6. Multiply $\frac{7}{8}$ - - by $13\frac{9}{10}$ - - *Facit* $12\frac{13}{80}$
7. Multiply $\frac{1}{2}$ of 7 - by $\frac{3}{5}$ - - - *Facit* $1\frac{9}{10}$
8. Multiply $\frac{3}{7}$ of 8 - by $\frac{7}{8}$ of 5 - - *Facit* 21
9. Multiply $\frac{3}{6}$ - - by $\frac{4}{9}$ of 11 - - *Facit* $2\frac{24}{54}$
10. Multiply $\frac{4}{5}$ of 91 by $71\frac{1}{2}$ - - - *Facit* $5205\frac{2}{10}$
11. Multiply $12\frac{3}{5}$ - by $\frac{2}{3}$ of 7 - - *Facit* $29\frac{12}{30}$
12. Multiply $7\frac{1}{2}$ - - by $9\frac{1}{4}$ - - - *Facit* $69\frac{3}{8}$

OF DIVISION OF VULGAR FRACTIONS.

2. HOW are Vulgar Fractions divided?

A. 1. Prepare the numbers given (if need be) by the rules of Reduction.

2. Multiply the Denominator of the Divisor into the Numerator of the Dividend, for a new Numerator; and the Numerator of the Divisor into the Denominator of the Dividend, for a new Denominator.

Note 1. When the dividend is greater than the divisor, the quotient will be greater than the dividend: But when the dividend, is less than the divisor, then the quotient will be less than the dividend, and in the same proportion as an unit is greater or less than the dividing Fraction.

2. *Multiplication* and Division prove each other.

EXAMPLES.

1. Divide $\frac{17}{21}$	by $\frac{3}{5}$	Facit $1\frac{22}{63}$
2. Divide $\frac{13}{19}$	by $\frac{7}{5}$	Facit $\frac{71}{133}$
3. Divide $\frac{14}{18}$	by $\frac{7}{10}$	Facit $1\frac{140}{126}$
4. Divide $1\frac{1}{2}$	by $4\frac{8}{10}$	Facit $\frac{30}{96}$
5. Divide $\frac{7}{8}$	by 4	Facit $\frac{7}{32}$
6. Divide 4	by $\frac{7}{8}$	Facit $4\frac{4}{7}$
7. Divide 99	by 108	Facit $\frac{99}{108}$
8. Divide $\frac{1}{8}$ of 19	by $\frac{2}{3}$ of $\frac{3}{4}$	Facit $7\frac{18}{80}$
9. Divide $\frac{1}{2}$ of $\frac{2}{3}$	by $\frac{2}{3}$ of $\frac{3}{4}$	Facit $\frac{34}{36}$
10. Divide $\frac{2}{3}$ of $\frac{3}{4}$	by $\frac{1}{2}$ of $\frac{2}{3}$	Facit $1\frac{12}{24}$
11. Divide $4\frac{5}{9}$	by $\frac{5}{9}$ of 4	Facit $2\frac{1}{20}$
12. Divide $\frac{5}{9}$ of 4	by $4\frac{5}{9}$	Facit $\frac{20}{41}$

OF THE SINGLE RULE OF THREE DIRECT IN VULGAR FRACTIONS.

HOW is the Rule of Three in Fractions performed?

A. The operation of the Rule of Three in Fractions, both Single and Double, Vulgar and Decimal, are exactly agreeable to the principle laid down in the same rules in whole numbers.

Q. How are the following examples proved?

A. By changing the order of them.

EXAMPLES.

1. If $\frac{11}{15}$lb. of Sugar cost $\frac{7}{15}$ of a shilling, what cost $\frac{32}{43}$ lb.? Ans. $\frac{2\,91\,2}{70\,95}s.=4d.$ 3 qrs. $\frac{497\,1}{7095}$.

2. If $\frac{3}{5}$ ell cost $\frac{2}{3}l.$ what cost $\frac{12}{17}$ ell? Ans. $15s.$ $8d.\frac{36}{165}$

3. If $\frac{4}{7}$ ell cost $\frac{7}{13}l.$ what cost 1 ell? Ans. $18s.$ $10d.$ $\frac{6}{32}$

4. If 2 oz. of Silver cost $15s.$ $5d.$ what cost $\frac{3}{4}$ oz.? Ans. $6s.$ $1d.$ 3 qrs. $\frac{1}{2}$.

5. If 6 yards $\frac{1}{2}$ cost $18s.$ what cost 9 yards $\frac{1}{4}$? Ans. $1l$ $5s.$ $7d.$ 1 qr. $\frac{28}{32}$.

6. If 1 dollar be worth 56, $\frac{3}{5}d.$ what are 500 dollars worth? Ans $117l.$ $18s.$ $4d.$

7. If 1 yd. $\frac{1}{4}$ cost $9s.$ what cost 16 yds. $\frac{1}{4}$? Ans. $5l.$ $17s.$

8. If 1 pistole be $17s.$ $\frac{1}{5}$, what are 100 pistoles? An. $864l.$

9. If $\frac{5}{7}$ oz. cost $\frac{1}{12}l.$ what cost 1 oz.? Ans. $1l.$ $5s.$ $8d.$

10. If an ingot of Silver weighs 16 oz. $\frac{11}{15}$, what is it *worth at 5s. 6d.* per oz.? Ans. $4l.$ $12s.$ $0d.$ 1 qr. $\frac{9}{15}$.

11. If $\frac{9}{10}$ C cost 14*l*. 4*s*. what will 7 C. $\frac{1}{2}$ cost? Answ. 118*l*. 6*s*. 8*d*.

12. If $\frac{3}{8}$ of an ell cost $\frac{2}{3}$ of 19*s*. what cost 7 ells? Ans. 7*l*. 7*s*. 9*d*. 1 qr. $\frac{3}{8}$.

13. If 8 lb. of Tobacco cost 4*s*. 9*d*. $\frac{3}{4}$, what cost 1 lb.? Ans. 7*d*. $\frac{1}{5}$.

14. If 1 yd. of Broad Cloth cost 15*s*. $\frac{5}{8}$ what will 4 pieces, each containing 27 yds. $\frac{3}{5}$ cost? Ans. 85*l*. 10*s*. 11*d*. $\frac{3}{4}$.

15. A mercer bought 3 pieces $\frac{1}{2}$ of silk, each containing 24 yards $\frac{1}{3}$, at 6*s*. 0*d*. $\frac{1}{2}$ per yard—I demand the value of the 3 pieces $\frac{1}{2}$ at that rate? Ans. 25*l*. 14*s*. 6*d*. 2 qrs. $\frac{4}{13}$.

16. If $\frac{1}{3}$ lb. less by $\frac{1}{6}$ cost 13*d*. $\frac{1}{2}$, what cost 14 lb. less by $\frac{1}{3}$ of 2 lb.? Ans. 4*l*. 9*s*. 9*d*. $\frac{3}{5}$.

17. A merchant had 5 C. $\frac{3}{8}$ of Sugar, 6*d*. $\frac{1}{4}$ per lb. which he would barter for tea, at 8*s*. $\frac{5}{8}$ per lb.—I demand how much tea must be given for the sugar? Ans. 43 lb. $\frac{1}{4}$.

18. Bought 122 lb. of tea at 8*s*. $\frac{5}{8}$ per lb. and sold it for 70*l*. what was the gain per cent? Ans. 33*l*. 0*s*. 11*d*. $\frac{3}{8}$ $\frac{75}{1033}$*s*.

OF THE SINGLE RULE OF THREE INVERSE IN VULGAR FRACTIONS.

1. IF 3 $\frac{1}{4}$ yards of cloth that is 1 $\frac{1}{4}$ yard wide, be sufficient to make a cloke; how much must I have of that sort which is $\frac{4}{5}$ of a yard wide, to make a cloke of the same bigness? Ans. 4 $\frac{7}{8}$ yards.

2. If 16 men finish a piece of work in 28 $\frac{1}{5}$ days, how long will 12 men require to do the same work? Answ. 37 $\frac{28}{36}$ days.

3. If 1 $\frac{1}{4}$ yard in breadth require 20$\frac{1}{8}$ yards long to make a garment; what length will $\frac{3}{4}$ of a yard wide require to make the same? Ans. 34$\frac{4}{24}$.

4. How many pieces of merchandize, at 20*s*. $\frac{1}{8}$ per piece are to be given for 240 pieces $\frac{1}{7}$, at 12*s*. $\frac{1}{2}$ per piece? Ans 149 $\frac{3584}{2254}$ pieces.

5. How many yards of canvas that is 1 yard $\frac{1}{4}$ wide, will be sufficient to line 20 yards of Say, that is $\frac{3}{4}$ of a yd. wide? Ans. 12 yards of canvas.

OF THE DOUBLE RULE OF THREE IN VULGAR FRACTIONS.

1. IF 9 Students spend 10*l*. $\frac{7}{9}$ in 18 days; how much will 20 Students spend in 30 days? Answ. 39*l* 18*s*. 4*d* $\frac{360}{1858}$.

2. Three men having worked 19 days $\frac{1}{2}$ received 8*l* $\frac{9}{10}$, how much must 20 men have for 100 days $\frac{1}{4}$? Answ. 305*l*. 0*s*. 8*d*. $\frac{96}{463}$.

3. A man and his wife having laboured 1 day earned 4*s*. $\frac{6}{8}$; I demand how much they must have for 10 days, $\frac{1}{2}$; when their two sons helped them. Ans 4*l*. 17*s*. 1*d*. $\frac{1}{2}$.

4. A man with his family, which in all were 5 persons, did usually drink 7 gallons $\frac{4}{5}$ of Beer in a week; how much will be drank in 22 weeks $\frac{1}{2}$, when 3 persons more come into their family? Ans. 280 $\frac{20}{40}$ gallons.

5. Seven men with their wives, upon examining into their expences for 20 weeks past, found that they laid out 40*l*. $\frac{4}{5}$; I demand in what time 20*l*. $\frac{3}{7}$ may be spent by 46 men in the like proportion? Ans. 3 weeks $\frac{3936}{6568}$.

6. Three sailors having been abroad 9 months $\frac{1}{4}$, received 40*l* $\frac{3}{15}$, I demand how much 100 sailors must receive for 28 months $\frac{3}{7}$ service? Ans. 4118*l* 6*s*. 0*d*. 2 qr. $\frac{1305}{11685}$.

THE

SCHOOLMASTER'S

ASSISTANT.

PART III.

OF DECIMAL FRACTIONS.

Q. WHAT do you understand by Decimals in general?

A. Any thing which is called one; as one foot, one pound, one shilling, one year, &c. is conceived in imagination to be divided into ten equal parts, and so on, by a Decimal Division, without end.

Q. What is a Decimal Fraction?

A. Any number having a point placed before it, thus, .641 is a decimal.

Q. How do you distinguish a whole number from a Decimal Fraction?

A. Any number having a point placed after it, thus, 641. is a whole number.

Q. What is a mixt number?

A. Any quantity of figures having a point placed somewhere between them, thus, 6.41, or thus, 64.1, is a mixt number.

Note. The Decimal Points must never be omitted; because without it, a Decimal cannot be distinguished from a whole or mixt number. But when a whole number alone is given, it is as common to omit it as to insert it; as appears by several Examples following.

OF NOTATION OF DECIMALS.

Q. HOW do Decimal Places increase?

A. In the same manner as whole numbers do; that is, by tens; for every place towards the left hand is ten *times greater* than that which is next it towards the *right hand*, as appears by the following table.

TABLE.

C. Thousands	X. Thousands	Thousands	Hundreds	Tens	Units	Tenth Parts	Hundredth Parts	Thousandth Parts	X. Thousandth Parts	C. Thousandth Parts
6	5	4	3	2	1	2	3	4	5	6

Q. May not Cyphers sometimes be annexed to D mals ?

A. They may, but they alter not their value : T .41 and .4100 are the same.

Q. May not Cyphers sometimes be prefixed to D mal Parts ?

A. Yes ; and then they decrease their Value by rei ing them farther from the point : thus. 0041 is than .41.

OF ADDITION AND SUBTRACTIO OF DECIMALS.

Q. HOW are Decimals added or subtracted ?

A. Place the Numbers according to their V and work as in Addition or Subtraction of whole n bers.

Q. How are the operations proved ?

A. As in whole numbers.

Examples in Addition.

Shillings.	*Yds.*	*Gallons.*	*L*
14.471	47.4	7004.16	71.0
1.191	19.71	712.712	120.0
1.8126	461.721	19.0174	31.1
3.6126	400.004	7.3126	13.4
7.1281	7.1004	71.1851	76.0
18.8126	7.07	3.108	7.3

Miles.	*lb.*	*Acres.*	*Ounces.*
41.8102	86.16104	.61271	48.9108
140.037	3.14	.8712	1.8191
18.10	1.181	.012	3.1080
7.8141	7.7121	.87	.7012
16.4612	8.19817	.04	.0012
7.81	13.071	.4	.0018

Examples in Subtraction.

	Years.	*Days.*	*Weeks.*	*Hours.*
From	1081.761	712.10009	127.19	12.
Take	10.00989	7.121	121.	.12
Rem.				

	Minutes.	*Months.*	*Ells.*	*Tons.*
From	174.1	6100.	.172618	761.1809
Take	1.471	6.109	.0000148	18.9112
Rem.				

OF MULTIPLICATION OF DECIMALS.

Q. How are Decimals multiplied?

A. As whole numbers are.

Note 1. When numbers are multiplied, make as many decimal parts in the product as there are in two Factors taken together.

2. If Decimal places are wanted in the product, supply them with cyphers to the decimal point.

3. Observe the same note here, which is given in multiplication of vulgar fractions.

Q. How are the following examples proved?

A. By inverting the Factors.

Examples.

1. Multiply .612 by 4. 12
2. Multiply 48. by .48
3. Multiply 37.9 by 46.5
4. Multiply .121 by 17.2
5. Multiply 1.81 by 71.
6. *Multiply* 4.1 by 1.42
7. *Multiply* .00071 by .121
8. Multiply .00041 by .00017
9. Multiply .0027 by 41.
10. Multiply 410. by .0012
11. Multiply .07 by .07
12. Multiply 1.007 by .041
13. Multiply 4.001 by .004
14. Multiply .004 by .004

OF DIVISION OF DECIMALS.

Q. HOW are Decimals divided?

A. As whole Numbers are.

Note. 1. The decimal places of the divisor and quotient must always be equal to those in the dividend.

2. If there be more decimals in the divisor than in the dividend, annex as many cyphers as you please to the dividend, so as to be equal at least to the divisor.

3. If Decimal places are wanting in the quotient, they must be supplied with cyphers to the decimal point.

4. Observe the same note here, which is given in division of vulgar fractions.

Q. How are the following examples to be proved?

A. By Multiplication.

EXAMPLES.

1. Divide 19.4	by 37.4	7. Divide 9.	by .7121
2. Divide 47121.1	by 47.	8. Divide 9.	by .9
3. Divide 4.18	by .1812	9. Divide 14.	by 47.31
4. Divide .76121	by 41.	10. Divide 1.	by 863.
5. Divide .612821	by 7.21	11. Divide .012181	by .12
6. Divide .121819	by .721	12. Divide .0001212	by .018

OF REDUCTION OF DECIMALS.

CASE 1.

Q. HOW do you reduce a Vulgar Fraction to a Decimal?

A. Divide the upper Term by the lower.

Note 1. Both terms are to be esteemed whole numbers.

2. By this case, tables containing the decimal parts of an integer are constructed.

EXAMPLES.

1. Reduce $\frac{5}{6}$ to a Decimal. Facit .1923076+

2. Reduce $\frac{5}{28}$ to a Decimal. Facit .1785714+

3. Reduce $\frac{11}{14}$ of $\frac{10}{13}$ to a Decimal. Facit .6043956+

4. Reduce 7*s* 6*d* to the Decimal of a pound. Facit .375*l*.

5. Reduce 10*s* 9*d* $\frac{1}{4}$ to the Decimal of a pound. Facit .6385416+*l*.

6. Reduce 24 Grains to the Decimal of a lb. Troy. Facit .0041666+lb.

7. Reduce 14 drams to the Decimal of a lb. Avoirdupois. Facit .0546875 lb.

8. Reduce 4 C. 2 qrs. to the Decimal of a ton. Facit .225 T.

9. Reduce 14 C. to the Decimal of a ton. Facit .7 ton.

10. Reduce 174 drams to the Decimal of an C. Facit .0060686+C.

11. Reduce 4 inches to the Decimal of a yard. Facit .1111111+yard.

12. Reduce 76 yards to the Decimal of a mile. Facit. .04318181+mile.

13. Reduce 1 mile to the Decimal of a league. Facit .33333333+league.

14. Reduce 3 qrs. 2 na. to the Decimal of a yard. Facit .875 yd.

15. Reduce 4 perches to the Decimal of an acre. Facit .025 acre.

16. Reduce 1 pint to the Decimal of a gallon. Facit .25 gal.

17. Reduce 1 gallon of wine to the Decimal of a hhd. Facit .015873+hhd.

18. Reduce 7 minutes to the Decimal of a day. Facit .0048611+day.

19. Reduce 2 days to the Decimal of a week. Facit .2857142+week.

20. Reduce 72 days to the Decimal of a year. Facit 1972602+year.

CASE 2.

Q. How do you find the proper quantity of a Decimal Fraction in the known parts of an Integer?

A. Multiply it by the common parts of an Integer.

Q. How do you prove Questions in this Case?

A. By Case 1.

EXAMPLES.

1. What is the proper quantity of .76 of a pound? Ans. 15*s* 2*d* 1 .6qr.

2. What is the proper quantity of .861 of a Cwt.? Ans. 3 qrs. 12 lb. 6 oz. 14 .592 dr.

3. What is the proper quantity of .461 of a shilling? Ans. 5*d* 2 .128 qrs.

4. What is the proper quantity of .761 of a hhd. of wine? Ans. 47 gals. 3 qts. 1 .544 pt.

5. What is the proper quantity of .17 of a ton of wine? Ans. 42 gals. 3.36 qts.

6. What is the proper quantity of .761 of a day? Ans. 18 hrs. 15 min. 50.4 sec.

7. What is the proper quantity of .7 of a lb. of silver? Ans. 8 oz. 8 dwts.

8. What is the proper quantity of .71 of 4 oz. of gold? Ans. 2oz. 16 dwts. 19.2 gr.

9. What is the proper quantity of .67 of a league? Ans. 2 miles, 0 fur. 3 poles, 1 yd. 0 feet, 3 in. 1.8 b.c.

10. What is the proper quantity of .712 of a furlong? Ans. 28 poles, 2 yds. 1 foot, 11.04 in.

11. What is the proper quantity of .07 of a barrel of ale? Ans. 2 gals. 1.92 pt.

12. What is the proper quantity of .4712 of an ell English? Ans. 2 qrs. 1.424 na.

13. What is the proper quantity of .72 of a hhd. of Beer? Ans. 38 gals. 3.52 qts.

14. What is the proper quantity of .61 of a ton of wine? Ans. 2 hhds. 27 gals. 2 qts. 1.76 pt.

15. What is the proper quantity of .092 of 3 acres, 2 roods? Ans 1 rood, 11.52 poles.

16. What is the proper quantity of .461 of a chaldron of coal? Ans. 16 bush. 2.384 pecks.

17. What is the proper quantity of .712 of 3 qrs. of corn? Ans. 17 bush. 2.816 qts.

18. What is the proper quantity of .3 of a year? Ans. 109 days, 12 hrs.

19. What is the proper quantity of .5 of an hour? Ans. 30 m.

20. A certain Tenant hired an House for 9 years at 12.4*l* per annum; how much was due at the end of the term? Ans 111*l* 12*s*.

Note 1. To this case is referred case 4, in Practice, p. 83.

EXAMPLES.

1286 at 4*s*.

1st. 4*s*. = 2*l*.

2d. 1286

.2 Facit 257*l*. 4.

257.2

20

4.0

2. Addition and Subtraction of Decimals of different denominations may easily be performed, after the Decimals are reduced to their proper quantities.

EXAMPLES.

1. What is the sum of .48*l* and 16*s* reduced to their proper quantities? Ans. 9*s*. 9. 12*d*.

2. What is the sum of .17 lb. Troy, and .48 oz.? Ans. 2 *oz.* 17 *dwt.* 14.4 gr.

3. What is the sum of .17 ton .19 C. 17 qr. and 7 lb? Ans. 3 C. 2 qrs. 15.54 lb.

4. What is the difference between .17*l* and .7*s* ? Ans. 2*s* 8*d* 1.6 qrs.

5. What is the difference between .41 days and .16 hours ? Ans. 9 hrs. 40 min. 48 sec.

OF THE SINGLE RULE OE THREE DIRECT IN DECIMALS.

Q. HOW do you prove the following questions ?
A. By changing their order.

EXAMPLES.

1. If 1.4 lb. of mace cost 14.5*s* what cost 75.31 lb. ? Ans. 38*l* 19*s* 11*d* 3.52 qrs.

2. If 1.6 C. of sugar cost 3*l* 12.76*s* what cost 3 hhds each 11 C. 3 qrs. 10.12 lb. ? Ans. 80*l* 15*s* 3*d* 3.36 qrs.

3. If 1.5 oz. of Silver be worth 7.8*s*. what is the value of 9.7 lb. ? Ans. 30*l* 5*s* 3*d* 1.44 qr.

4. If 1.47 C. of Sugar be worth 4.5*l* what is 1.7 lb worth at that rate ? Ans. 11.1d.

5. If one pint of wine cost 1.2*s* what cost 12.5 hhds. ? Ans. 378*l*.

6. If 8.4 lb. of Tobacco cost 16*s* 4.6d what cost 3 hhds. each 4 C. 2 qrs. 7.4 lb. ? Ans. 149*l*. 12*s* 3*d* 2 qrs.

7. If a yard of cloth cost 12.3*s* what cost 3 pieces, each 21.5 yards ? Ans. 39*l* 13*s* 4.2d.

8. A man bought a piece of Cloth for 6*l* 13.12*s*. I demand how many yards there were in the same, when he gave after the rate of 4*s* 2.6d per yard ? Ans. 31 .569 yards.

9. A man bought 5.8 tons of oil for 60.4*l* but by misfortune it chanced to leak out 50.9 gallons ; I demand how he must sell the rest per gallon to be no looser ? Ans. 10.27d per gallon.

10. Two men bartered, A had 40.7 yards of linen, for which B gave him 25.6 ells of Holland, at 4.5*s* per ell ; I demand the price of the linen per yard ? Answ. 2*s* 9*d* 3.8 qr.

11. A grocer bought 7.6 C. of Sugar, at 40.1*s* per C. and sold the same out at 4.5d per lb. I demand whether he gained or lost, and how much ? Ans. 14*s* 5d 1.12 qr gain.

12. A Brewer made a quantity of Beer, which cost him 90.4*l* and afterwards sold it out at 26.7*s* per barrel, by which he gained 10*l* I demand the quantity that was brewed? Answ. 75 bar. 7.4+gals.

13. A Grocer bought 3 C. 1.5 qr. of cloves, at the rate of 2.75s per lb. and sold them for 60*l*. 11*s* 6*d* what did he gain or lose by the bargain? Ans. he gained 8*l* 12*s*.

14. A merchant bought 436 yards of cloth for 8.5s per yard, and sold it again for 10.75s per yard, what did he gain by the sale thereof? Ans. 49*l* 1*s* gain.

15. A owes B 296.85*l* but he compounds for 7.5*s* in the pound; what must B receive for his debt? Answ. 111*l* 6*s* 4*d* 2 qrs.

16. Bought 3 hhds of Tobacco, each weighing 4 C. 1.9 qr. at 5.6*l* per C. which I sold out at 7*l* 16*s* per C. what did I gain by the whole? Ans. 29*l* 10*s* 8*d* 1.6 qr.

17. A Jeweller bought a Diamond for 60 guineas: and after it was neatly cut, weighed 1.5 oz which he sold again for 3.25s per grain: I demand how much he gained by the said Diamond; and also at what rate per cent. he made his gain?

Ans. { Whole gain 54*l* 0*s* 0*d* 0 qr.
{ Gain per cent. 85 14 3 1.7+

OF THE SQUARE-ROOT.

Q. WHAT is a Square?

A. Any Number multiplied by itself produces a Square.

Q. What is the Extraction of the Square-Root?

A. If a Square be given to find one side it is called the extraction of the Square-Root?

Q How is the given Square to be prepared for extraction?

A. By pointing off at every two figures, from the units place, both ways for a resolvend.

Q. What is a Surd?

A. It is an imperfect Square, or such a number whose Square Root can never be exactly found.

EXAMPLES.

1. *What is* the Square of 17.1? Answ. 292.41
2. *What is* the Square of .09? Answ. .0081

Of Converging Series, *or* Extracting *the* Roots *of all* Powers.

A TABLE OF POWERS.

Roots, or First Powers	1	2	3	4	5	6	7	8	9
Squares, or Second Powers	1	4	9	16	25	36	49	64	81
Cubes, or Third Powers	1	8	27	64	125	216	343	512	72
Biquadrates, or Fourth Powers	1	16	81	256	625	1296	2401	4096	6561
Sursolids, or Fifth Powers	1	32	243	1024	3125	7776	16807	32768	59049
Square Cubes, or Sixth Powers	1	64	729	4096	15625	46656	117649	262144	531411
Second Sursolids, or Seventh Powers	1	128	2187	16384	78125	279936	823543	2097152	4782969
Biquadrates squared, or Eighth Powers	1	256	6561	65536	390625	1679616	5764801	16777216	43046721
Cubes Cubed, or Ninth Powers	1	512	19683	262144	1953125	10077696	40353607	134217728	387420489
Sursolids squared, or Tenth Powers	1	1024	59049	1048576	9765625	60466176	282475249	1073741824	3486784401
Third Sursolids, or Eleventh Powers	1	2048	177147	4194304	48828125	362797056	1977326743	8589934592	38381059609
Square Cubes squared, or Twelfth Powers	1	4096	531441	16777216	244140625	2176782336	13841287201	68719476736	282429536481
Fourth Sursolids, or Thirteenth Powers	1	8192	1594323	67108864	1220703125	13060694016	96889010407	549755813888	2541865828329
Second Sursolids squared, or Fourteenth Powers	1	16384	4782969	268435456	6103515625	78364164096	678223072849	4398046511104	22876792454961
Sursolids cubed, or Fifteenth Powers	1	32768	14348907	1073741824	30517578125	470184984576	4747561509943	35184372088832	205891132094449

3. What is the Square of .0094 ?	Answ. .00008836
4. What is the Square-Root of 4712.81261 ? - - - - -	Answ. 68.649 +
5. What is the Square-Root of 9712 718051 ? - - - - -	Answ. 98.553 +
6. What is the Square-Root of 3.1721812 ? - - - - -	Answ. 1.78106 +
7. What is the Square-Root of 1.3976121 ? - - - - -	Answ. 1.1822 +
8. What is the Square-Root of 761.801216 ? - - - - -	Answ. 27.6007 +
9. What is the Square-Root of .0007612816 ? - - - - -	Answ. .02759 +
10. What is the Square-Root of 4.000067121 ? - - - - -	Anw. 2.000016 +

11. There is an army consisting of a certain number of men, who are placed rank and file, that is, in the form of a Square, each side having 472 men ; I demand how many men the whole square contains ? Ans. 222784 men.

12. The floor of a certain great room is made exactly square, each side of which contains 75 feet; I demand how many square feet are contained therein? Ans. 5626 feet.

13. Suppose 12544 Soldiers are to be put into rank and file, in the form of an equal square ; I demand how many Soldiers will be in the front, and how many deep? Ans. 112.

14. A certain square pavement contains 197136 square stones, all of the same size ; I demand how many are contained in one of its sides ? Ans. 444.

15. The wall of a town is 17 feet high, which is surrounded by a moat, of 20 feet in breadth ; I demand the length of a ladder which shall reach from the outside of the moat to the top of the wall ? Ans. 26.2 + feet.

OF THE SQUARE-ROOT OF A VULGAR FRACTION.

Q. How is the Square-Root of a Vulgar Fraction extracted?

A. 1. Reduce the Fraction to its lowest terms.

2. Extract the Square-Root of the Numerator for a new Numerator, and the Square-Root of the Denominator for *a new Denominator.*

3. If the fraction be a Surd, reduce it to a Decimal, *and then* extract the Square-Root from it.

4. The Decimal Fractions must consist of an even number of places, as two, four, &c.

EXAMPLES.

1. What is the Square-Root of $\frac{3044}{6889}$? Answ. $\frac{2}{3}$.
2. What is the Square-Root of $\frac{3456}{5400}$? Answ. $\frac{4}{5}$.
3. What is she Square-Root of $\frac{7056}{9216}$? Answ. $\frac{7}{8}$.

SURDS.

4. What is the Square-Root of $\frac{3168}{81000}$? Answ. .71528+
5. What is the Square-Root of $\frac{.08}{.72}$? Answ. .87447+
6. What is the Square-Root of $\frac{387}{738}$? Answ. .72414+

OF THE SQUARE-ROOT OF A MIXT NUMBER.

Q. How is the Square-Root of a mixt number extracted?

A. 1. Reduce the Fractional part of the mixt number to its lowest term.

2. Reduce the mixt number to an improper fraction.

3. Extract the Roots of the Numerator and Denominator, for a new Numerator and Denominator.

4. If the mixt number given be a Surd, reduce the fractional part to a Decimal, and annex it to the whole number, and extract the Square Root from the whole.

EXAMPLES.

1. What is the Square-Root of $37\frac{36}{49}$? Answ. $6\frac{1}{7}$.
2. What is the Square-Root of $17\frac{1}{25}$? Answ. $4\frac{1}{5}$.
3. What is the Square-Root of $5\frac{289}{649}$? Answ. $2\frac{4}{3}$.

SURDS.

4. What is the Square-Root of $76\frac{1}{10}$? Answ. 8.7649+
5. What is the Square-Root of $7\frac{9}{11}$? Answ. 2.7961+

OF THE CUBE-ROOT.

Q. WHAT is a Cube?

A. Any Number multiplied by its Square, produces a Cube.

Q. What is the extraction of the Cube-Root.

A. If a Cube be given to find out a Number, which being multiplied into its Square, produceth the number given: this is called the extraction of the Cube-Root.

Q. How is the given Cube to be prepared for Extraction?

A. By pointing off at every three Figures, both ways, from the units place, for a resolvend.

Q. What is a Surd?

A. It is an imperfect Cube, or such a Number, whose Cube-Root can never be exactly found.

Q. What is the rule for extracting the Cube-Root of a Number.

A. This: the first figure sought is the Root of the greatest Cube contained in the first member, and it is called a; then $3aa+3a$ is the Divisor, which finds a new figure called e; then $3aae+eea+eee$ is the Subtrahend or Number to be subducted; which operation is to be continued to every resolvend.

Note. This rule being somewhat dark, I shall by way of illustration subjoin the operation, at large, for extracting the Cube-Root of any number.

What is the Cube-Root of 444194.947?

(1) Let the given number be pointed as before directed.

thus 444194.947

(2) The first member, which contains the greatest Cube, is 444; and the nearest Root, whose Cube is not greater than it, is 7, which set

thus 444194.947(7

(3) The Cube of 7 is 343, which set down and subtract, annexing the next three figures or member, viz. 194 for a resolvend;

thus 444194.947(7
343

101194 Resolvend.

(4) The number 7, in the Root is called a; then by the Rule $3aa=3a$ is the Divisor.

$7=a$
$7=a$

$49=aa$
3

$147=3aa$
$21=3a$

Divisor $1491=3aa\times 3a$

444194.947(7
343

1491)101194 Resolvend.

(5) The next figure in the Root, viz. 6 (found by common Division) is called e; then by the rule $3aae+3eea+eee$ is the Subtrahend, or Number to be subducted; thus,

$147=3aa$
$6=e$

$882=3aae$
$756=3eea$
$216=eee$

eee viz. $6=216$

$6=e$
$6=e$

$36=ee$
3

$108=3ee$
$7=a$
$756=3eea$

Sub. $95976=3aae+3eea+eee$

444194.947(76
343

1491(101194 Resolvend
95976 Subtrahend.

5218.947 Resolvend.

(6) When the next member is brought down, viz. 947 as before, both figures in the Root, viz. 76 must be called a; then to find a Divisor to this last Resolvend, say, as before, $3aa+3a$; thus,

$76=a$
$76=a$

456
532

$5776=aa$
3

$17328=3aa$
$228=3a$

$76=$
$3=$

$228=3a$

444194.947(76
343

1491)101194 Resolvend
95976 Subtrahend

173508(5218.947 Resolvend.

Divis. $173508=3aa+3a$

(7) The next figure in the Root, viz. 3, found as before, is also called e; then again $3aae+3eea+eee$ is the other Subtrahend or number to be subducted; thus,

$17328 = 3aa$
$3 = e$
$51984 = 3aae$
$2052 = 3eea$
$27\ eee$
Sub. $5218947 = 3aae + 3eea + eee$

eee viz. $3 = 27$

$3 = e$
$3 = e$
$9 = ee$
3
$27 = ee$
$76 = a$
162
189
$2052 = 3eea$

444194.947(76.3 Answer.
343
1491)101194 Resolvend
95976 Subtrahend
173508)5218 947 Resolvend
5218 947 Subtrahend
0

Examples.

1. What is the Cube of 6.4? Answ. 262.144
2. What is the Cube of .13? Answ. .002197
3. What is the Cube of 41.1? Answ. 69426.531
4. What is the Cube of .09? Answ. .000729
5. What is the Cube of .007? Answ. .000000343
6. What is the Cube-Root of 7612.812161? - - - - Answ. 19.67+
7. What is the Cube-Root of 7612181.7612? - - - Answ. 196.71
8. What is the Cube-Root of 61218.00121? - - - Answ. 39.41+
9. What is the Cube-Root of 7121.1021698? - - - Answ. 19.238
10. What is the Cube-Root of 12000.812161? - - - Answ. 22.89+
11. What is the Cube-Root of .121861281? - - - - Answ. .495+
12. What is the Cube-Root of .0069761218? Answ. .19107.

13. If a cubical piece of timber be 41 inches long, *inches* broad, and 41 inches deep, how many cubical *ches* doth it contain? Ans. 68921 cubical inches.

14. Suppose a Cellar to be dug, that shall be 12 feet every way, in length, breadth and depth; how many solid feet of earth must be taken out to complete the same? Ans. 1728.

15. Suppose a stone of a cubic form to contain 474552 solid inches; what is the superficial content of one of its sides? Ans. 6048 inches.

OF THE CUBE-ROOT OF VULGAR FRACTIONS.

Q. How do you extract the Cube-Root of a Vulgar Fraction?

A. 1. Reduce the Fraction to its lowest terms.

2. Extract the Cube-Roots of the Numerator and Denominator for a new Numerator and Denominator.

3. If the Fraction be a Surd reduce it to a Decimal, and then extract the Cube-Root from it.

4. The Decimal Fraction must consist of Ternaries of places; as three, six, nine, &c.

EXAMPLES.

1. What is the Cube-Root of $\frac{343}{1331}$? Ans. $\frac{7}{11}$
2. What is the Cube-Root of $\frac{1944}{4096}$? Ans. $\frac{3}{4}$
3. What is the Cube-Root of $\frac{648}{1000}$? Ans. $\frac{3}{5}$

SURDS.

4. What is the Cube-root of $\frac{4}{9}$? Ans. .763+
5. What is the Cube-root of $\frac{6}{7}$? Ans. .949+
6. What is the Cube-root of $\frac{1}{3}$? Ans. .693+

OF THE CUBE-ROOT OF A MIXT NUMBER.

Q. How do you extract the Cube-Root of a mixt number?

A. 1. Reduce the fractional part to its lowest terms.

2. Reduce the mixt number to an improper fraction.

3. Extract the Cube-Roots of the Numerator and Denominator, for a new Numerator and Denominator.

4. If the mixt number given be a Surd, reduce the fractional part to a Decimal, and annex it to the whole number, and extract the Cube-Root from the whole.

EXAMPLES.

1 What is the Cube-Root of $578\frac{19}{27}$? Ans. $8\frac{1}{3}$.
2 What is the Cube-Root of $47\frac{7}{24}$? Ans $3\frac{1}{2}$.
3 What is the Cube-Root of $5\frac{104}{125}$? Ans. $1\frac{4}{5}$.

SURDS.

4 What is the Cube-Root of $8\frac{2}{14}$? Ans. 2.013+
5 What is the Cube-Root of $7\frac{3}{5}$? Ans. 1.966+

OF THE BIQUADRATE-ROOT.

Q. WHAT is a Biquadrate Number?

A. Any number involved four times produces a Biquadrate.

Q. How is the Biquadrate-Root extracted?

A. first extract the Square-Root of the given Resolvend, and then extract the Square-root of that Square-root, for the Biquadrate-root required.

EXAMPLES.

1 What is the Biquadrate of 48? Ans. 5308416.
2 What is the Biquadrate of 96? Ans. 84934565.
3 What is the Biquadrate-root of 5308416? Ans. 48.
4 What is the Biquadrate-root of 84934656? Ans. 96.
5 What is the Biquadrate-root of 21743271936? - - - - - - Ans. 384.

OF THE SURSOLID-ROOT.

Q. WHAT is a Sursolid?

A. Any Number involved 5 times produces a Sursolid.

Q. How is the Sursolid-root, or the root of any other higher power extracted?

A. By the following general rules.

1. If any even power be given, let the Square-root of it be extracted, which reduces it to half of the given power, then the square-root of that power reduces it to half of the same power; and so on till you come to a square or a cube.

For example; Suppose a 24th power be given; the Square-root of that reduces it to a 12th power, the square-root of the 12th power reduces it to the 6th power; and the Square-root of the 6th power to a Cube.

2. If any odd power be given, as the 17th, &c. observe

[1] From the unity place, both ways, point off at every such number of figures as is the index of the power for a resolvend.

[2] Seek in the table of powers, for such a power (*being the same* power with the index) as comes nearest the *first period*, whether greater or less, calling its root *accordingly more* than just, or less than just.

[3] Annex so many Cyphers to the root, as there are periods of whole numbers in the given resolvend.

[4] Find the difference between the given resolvend, and the power coming nearest the first period.

[5] Whatever odd power is given, the next lowest odd power to that of the said root must be found with its annexed cyphers? i. e. if the 9th power be given, find the 7th power of the root and cyphers: if the 11th power be given, find the 9th, &c.

[6] Multiply the next lower odd power by the index of the given power, and let that product be a divisor to the difference between the given resolvend and power first found, which depresses it to a square.

[7] Point this square into periods of two figures each.

[8] Then make the first root without its cyphers a divisor, and ask how often it may be found in the first period of the square.

[9] If the divisor be less than just, you must multiply the quotient figure by half the index, i. e. if the index be 11, multiply the quotient figure by 5; if the index be 9, multiply it by 4, &c. and add it to the divisor, but if it be more than just you must subtract it from the divisor, having a cypher annexed or supposed to be annexed to the divisor; which sum or difference must be multiplied by the said quotient figure, and so continued to every new figure in the quotient.

[10] If the first root with its cyphers be more than just, the quotient must be subtracted from it; but if it be less than just, it must be added to it; and the sum or difference will be the root required.

3. If an even power be given, and the square root of that power be extracted, reduce it to an odd power: you must then proceed with that odd power: as the foregoing rules direct.

Examples.

1 What is the sursolid of 6436343?

6436343

32 the nearest sursolid, whose root and cypher is 20

3236343

The cube of 20 is=8000

And 8000 × 5 is=40000

Then 40000) 3236343(80 — Lastly 20
Again 2)80(3 + 3
+ 3 × 2=6 78

1st divisor=26— 23 the sursolid
2 to be rejected. Root required.

Note, This is a very expeditious way of extracting the roots of high powers but it is not always exact, because (as Mr. Ward observes, for it was taken from him) there will be a remainder, and sometimes an excess or defect in the last figure of the root, when the given resolvend or power hath a true root; as appears from the fifth example following, whose true root should not be 384.3 as it there stands, but 384.

2. What is the sursolid of 48? Answ 254803968.
3. What is the sursolid-root of 8153726976? Ans 96.
4. What is the sursolid-root of 254803968? Answ. 48.
5. What is the sursolid-root of 8349416423424? - - - - - Answ. 384.3

OF THE SQUARE-CUBE ROOT.

Q. WHAT is a Square-Cube?
A. Any number involved six times produces a square-cube.

EXAMPLES.

1. What is the square-cube of 48.? - - - - - - - - Answ. 12230590464.
2. What is the square-cube root of 782757789696? - - Answ. 96.
3. What is the square-cube root of 12230590464.? - - Answ. 48.
4. What is the square-cube root of 3206175906594816? Answ. 384.

OF THE SECOND SURSOLID-ROOT.

Q. WHAT is the Second Sursolid?
A. Any number involved seven times produces a second sursolid.

EXAMPLES.

1. What is the second sursolid of 96.? - - - - - - Answ. 751447478108 16.
2. What is the second sursolid-root of 751447478108 16.? - - - - - Answ. 96.
3. What is the second sursolid-root of 587068342272.? - - - - - - Answ. 48.
4. What is the second sursolid-root of 1231171548132409344.? - - Answ. 384.42.

OF THE SQUARE-BIQUADRATE ROOT.

Q. WHAT is a Square-Biquadrate ?

A. Any number involved eight times, is a Biquadrate squared, or square-biquadrate.

EXAMPLES.

1. What is the squared Biquadrate of 48. ? } Ans. 28179280429056.
2. What is the square biquadrate-root of 7213895789838336. ? } Ans. 96.
3. What is the square biquadrate-root of 28179280429056 ? } Ans. 48.
4. What is the square biquadrate-root of 4727698744828451880 96 ? } Ans. 384.

OF THE CUBED-CUBE-ROOT.

Q. WHAT is a Cubed-Cube ?

A. Any number involved nine times is a Cubed-Cube.

EXAMPLES.

1. What is the Cubed-cube-root of 69253399582448025 6 ? } Ans. 96.2.
2. What is the Cubed-cube-root of 1352605460594688 ? } Ans. 48.09.
3. What is the Cubed-cube-root of 1815436318014125522288 64 ? } Ans. 384.5.

OF THE SQUARE SURSOLID-ROOT.

Q. WHAT is a Squared Sursolid ?

A. Any number involved ten times, produces a Squared Sursolid.

EXAMPLES.

1. What is the Squared Sursolid-root of 649250621085450 24 ? } Ans. 48.
2. What is the Squared Sursolid-root of 66483 263599150104576 ? } Ans. 96.
3. What is the Squared Sursolid-root of 69712754611742420055883776 ? } Ans 384.3.

OF THE THIRD SURSOLID-ROOT.

Q. WHAT is a third Sursolid ?

A. Any number involved eleven times produces a *third* Sursolid.

EXAMPLES.

1. What is the third Sursolid-root of 952809757913927 ? } Ans. 23.
2. What is the third sursolid-root of 3116402981210161152 ? } Ans. 48.
6. What is the third Sursolid root of 6382393305518410039296 ? } Ans. 96.

OF THE SQUARED SQUARE-CUBE-ROOT.

Q. WHAT is a Squared Square-Cube ?

A. any number involved twelve times produces a Squared Square-Cube ?

EXAMPLES.

1. What is the root of this Squared Square Cube 149587343098087735296 ? } Ans. 48.
2. What is the root of this Squared Square Cube 61270974772976736377241 6 ? } Ans. 96.
3. What is the root of this squared Square Cube 10279563944029090291760398073856 } Ans. 385.

A GENERAL RULE FOR EXTRACTING THE ROOTS OF ALL POWERS.

1. PREPARE the given number for extraction, by pointing off from the unity place, as the root required directs.

2. Find the first figures in the root by your own judgment, or by inspection into the table of powers.

3. Subtract it from the given number.

4. Augment the remainder by the next figure in the given number, that is by the first figure in the next point and call this your dividend.

5. Involve the whole root, last found, into the next inferior power to that which is given.

6. Multiply it by the index of the given power, and call this your divisor.

7. Find a quotient figure by common Division, and annex it to the root.

8. Involve all the root thus found, into the given power.

9. Subtract this power (always) from as many points of *the given power* as you have brought down, beginning at *the lowest place.*

10. To the remainder bring down the first figure of the next point for a new dividend.

11. Find a new divisor as before, and in like manner proceed till the work is ended.

EXAMPLES.

1 What is the cube-root of 115501303 ?

```
        115501303.(487
         64
        ---
    48)415 Dividend
       110592 Subtrahend
       ------
  6912)49093 Dividend
     115501303 Subtrahend
     ---------
             0
             -
  4 x   4 x   4 = 48 Divisor
 48 x  48 x  48 = 110592 Subtrahend
 48 x  48 x   3 = 6912 Divisor
487 x 487 x 487 = 115501303 Subtrahend.
```

2 What is the Biquadrate-root of 56249134561 ?

```
          56249134561.(487
          256
          ---
      256)3064 Dividend
          5308416 Subtrahend
          -------
  442368) 3164974 Dividend
          56249134561 Subtrahend
          -----------
                    0
                    -
  4 x   4 x   4 x   4 = 256 Divisor
 48 x  48 x  48 x  48 = 5308416 Subtrahend
 48 x  48 x  48 x   4 = 442368 Divisor
487 x 487 x 487 x 487 = 56249134561 Subtra.
```

Note, This general rule 1 received from my worthy friend, William Mountaine, Esq. F. R. s. and teacher of the mathematics at Shad-Thames.

OF SIMPLE INTEREST.

Q. WHAT particular letters are used here?

A. These : P, any principal.
T, the time.
R, the ratio of the rate per cent.
A, the amount.

Q. What is the ratio?

A. It signifies only the simple interest of 1*l* for one year, at any proposed rate of interest per cent and is thus found :

100 : 6 :: 1 : 0.06
100 : 5 :: 1 : 0.05

A TABLE OF RATIOS.

Rate per Cent.	Ratio.	Rate per Cent.	Ratio.
2	.02	$6\frac{1}{2}$	.065
3	.03	7	.07
$3\frac{1}{2}$	.035	$7\frac{1}{2}$	.075
4	.04	8	.08
$4\frac{1}{2}$	.045	$8\frac{1}{2}$	.085
5	.05	9	.09
$5\frac{1}{2}$	.055	$9\frac{1}{2}$	.095
6	.06	10	.1

CASE 1.

Q. When P, T, and R, are given to find A; how is it discovered?

A. Thus; $ptr+p=a$.

Note, any quantity of letters put together like a word, denote continual multiplication.

EXAMPLES.

1. What sum will 567*l* 10*s* amount to in 9 years, at 6 per cent per annum? Ans. 873*l* 19*s*.

2. What will 508*l* 14*s* amount to in 1 year, at 5 per cent. per annum? Ans. 534*l* 2*s* 8*d* 1.6 qrs.

3. What will 600*l* 14*s* amount to in 10 years, at $4\frac{1}{2}$ per cent. per annum? Ans. 871*l* 0*s* 3*d* 2.4 qrs.

4. What will 4000*l* amount to in 5 years, at $3\frac{1}{2}$ per cent. per annum? Ans. 4700*l*.

Note. When the time given does not consist of whole years; then reduce the odd time into decimal parts of a year. And unless such parts of a year chance to be 1-4, 1-2, or 3-4 of a year, the best way will be to reduce the odd times into days, and then work with the decimal parts of a year, that are equivalent to those days.

A table for the ready finding the decimal parts of a year equal to any number of days, or quarters of a year.

Days.	Decimal Parts.	Days.	Decimal Parts.	Days.	Decimal Parts.
1	.00274	10	.027397	100	.273973
2	.005479	20	.054794	200	.547945
3	.008219	30	.082192	300	.821918
4	.010959	40	.109589	365	1.000000
5	.013699	50	.136986		
6	.016438	60	.164383		
7	.019178	70	.191781	$\frac{1}{4}$ of a year	.25
8	.021918	80	.219178	$\frac{1}{2}$ of a year	.50
9	.024651	90	246575	$\frac{3}{4}$ of a year	.75

Note, When the true number of days cannot be found at one view in this table, then both them and their decimals must be taken out of the table at twice or thrice, as their number requires, and added together. So the decimal parts of a year=236 days are thus found.

200=.547945
30=.082192
6=.016438

236=.646575

EXAMPLES.

5. What will 7200*l.* amount to in 6$\frac{1}{2}$ years, at 5 per cent. per ann. ? Ans. 9540*l.*

6. What will 1110*l* 18s amount to in 12$\frac{3}{4}$ years, at 5 per cent. per ann. ? Ans. 1819*l* 1s 11d 2.8 qrs.

7. What will 280*l* 10s amount to in 3 years and 148 days, at 5 per cent. per ann. ? Ans. 328*l* 5s 2d. 3.38+qrs.

8. What will 196*l.* amount to in 189 days, at 4 per cent per ann. ? Ans. 200*l* 1s 2d 1.23+qrs.

CASE 2.

Q. When A, T & R are given to find P, how is it discovered?

A. Thus: $\frac{a}{tr+1}=P$

EXAMPLES.

1. I demand what principal will amount to 873*l* 19s in 9 years, at 6 per cent. per ann. ? Ans. 567*l* 10s.

2. I demand what principal will amount to 534*l* 2s 8d 1.6 qr. in 1 year, at 5 per cent. per ann. ? Ans. 508*l* 14s.

3. I demand what principal will amount to 9540*l.* in 6$\frac{1}{2}$ years, at 5 per cent per ann. ? Ans. 7200*l.*

4. I demand what principal will amount to 1819*l* 1s 11d 2.8 qrs. in 12$\frac{3}{4}$ years at 5 per cent. per ann. ? Ans. *1110l 18s.*

5. I demand what principal will amount to 871*l* 0s 3d 2.4 qrs. in 10 years, at $4\frac{1}{2}$ per cent. per ann.? Ans. 600*l* 14s.

6. I demand what principal will amount to 4700*l* in 5 years, at $3\frac{1}{2}$ per cent. per ann.? Ans. 4000*l*.

7. I demand what principal will amount to 328*l* 5s 2d 3.38 qrs. in 3 years and 148 days, at 5 per cent? Ans. 280*l* 10s.

8. What principal being put to interest for 189 days, at 4 per cent will amount to 200*l* 1s $2d\frac{1}{2}$? Ans. 196*l*.

CASE 3.

Q. When A, P, and T, are given to find R, how is it discovered? A. Thus: $\frac{a-p}{tp} = r$.

EXAMPLES.

1. At what rate per cent will 567*l*. 10s amount to 873*l* 19s in 9 years? Ans. 6*l* per cent.

2. At what rate per cent will 508*l* 14s amount to 534*l*. 2s 8d 1.6 qr. in 1 year? Ans. 5*l* per cent.

3. At what rate per cent will 7200*l*. amount to 9540*l*. in $6\frac{1}{4}$ years? Ans. 5*l*. per cent.

4. At what rate per cent will 1110*l*. 18s amount to 1819*l* 1s 11d 2.8 qrs. in $12\frac{3}{4}$ years? Ans. 5*l* per cent.

5. At what rate per cent will 600*l* 14s amount to 871*l* 0s 3d 2.4 qrs. in 10 years? Ans. $4\frac{1}{2}$ per cent.

6. At what rate per cent will 4000*l* amount to 4700*l*. in 5 years? Ans. $3\frac{1}{2}$ per cent.

7. At what rate per cent will 280*l* 10s amount to 328*l*. 5s 2d 3.38 qrs. in 3 years and 148 days? Ans. 5*l*. per cent.

8. At what rate per cent will 196*l* amount to 200*l* 1s $2d\frac{1}{2}$ in 189 days? Ans. 4*l*. per cent.

CASE 4.

Q. When A, P, and R, are given to find T, how is it discovered? A. Thus: $\frac{a-p}{rp} = T$.

EXAMPLES.

1. In what time will 567*l* 10s amount to 873*l* 19s at 6 per cent? Ans. 9 years.

2. In what time will 508*l* 14s. amount to 534*l* 2s 8d 1.6 qr. at 5 per cent? Ans. 1 year.

3. In what time will 7200*l*. amount to 9540*l* at 5 per cent? Ans. $6\frac{1}{2}$ years.

4. In what time will 1110*l* 18*s* amount to 1819*l* 1*s* 11*d* 2 qrs at 5 per cent? Ans. $12\frac{3}{4}$ years.

5. In what time will 600*l* 14*s* amount to 871*l* 0*s* 3*d* 2.4 qrs. at $4\frac{1}{2}$ per cent? Ans. 10 years.

6. In what time will 4000*l* amount to 4700*l* at $3\frac{1}{4}$ per cent? Ans. 5 years.

7. In what time will 280*l* 10*s* amount to 328*l* 5*s* 2*d* 3.38 qrs. at 5 per cent? Ans. 3 years 148 days.

8. In what time will 196*l* amount to 200*l* 1*s* $2d\frac{1}{2}$, at 4 per cent? Ans. 189 days.

OF ANNUITIES OR PENSIONS IN ARREARS.

Q. What is meant by annuities or pensions in arrears?

A. Annuities or Pensions are said to be in arrears, when they are payable, either yearly, half yearly, or quarterly, and are unpaid for any number of payments.

Note, U represents the annuity, pension, &c. R, T, and A, as before.

Case 1.

Q. When U, R, and T, are given to find A, how is it discovered? A. Thus; $tut-tu$

$$\frac{}{2} \times r + tu = a.$$

Examples.

1. If an annuity of 70*l* be forborn 5 years, what will it amount to in that time, at 5 per cent? Ans. 385*l*.

2. If the payment of a pension be omitted for 7 years, what will be the amount in that time at 6*l* per cent when the pension is 56*l* per ann.? Ans. 462*l* 11*s* 2*d* 1.6 qr.

3. A house is let upon lease for 7 years, as 50*l* per ann. I demand the amount for that time at 4*l* per cent for the forbearance of payment? Ans. 392*l*.

4. Suppose a salary of 100*l* per ann. be forborn 7 years, what is the amount at $4\frac{1}{2}$ per cent? Ans. 794*l* 10*s*.

Note, When the annuities or rents are to be paid by half-yearly or quartely payments, as most generally they are: then,

For half-yearly payments, take (always) half of the ratio, half of the yearly rent, and twice the number of years; that is, reduce the years into half-years, for R, U, and T: but,

For quarterly payments, take a fourth part of the ratio, a fourth part of the yearly rent, and four times the number of years; that is, reduce the years into quarters, and work as before.

5. If 70*l* annuity, payable every half-year, were unpaid 5 years, what will it amount to in that time at 5 per cent? *Ans. 389l 7s 6d.*

6. If 70*l* annuity, payable every quarter, were unpaid 5

years, what will it amount to in that time at 5 per cent? Ans. 391*l* 11*s* 3*d*.

Note, By comparing these two examples with the first, it may be observed, that the amount of half yearly payments is more advantageous than yearly payments, and quarterly than half-yearly payments.

Case 2.

Q. When A, R, and T, are given to find U, how is it discovered?

A. Thus: $\frac{2a}{trt-tr+2t}=u$

Examples.

1. If the amount of an annuity for 5 years at 5 per cent be 385*l* what is the annuity? Ans 70*l*.

2. If the amount of a pension be 462*l* 11*s* 2*d* 1.6 qr. the time be 7 years, and the rate per cent 6*l* what is the pension? Ans. 56*l*.

3. If a house be let upon lease for 7 years, and the amount for that time be 392*l* at 4 per cent what is the yearly rent? Ans. 50*l*

4. If a salary amounts to 794*l* 10s in 7 years, at 4½ per cent what is the salary? Ans. 100*l* per ann.

Note, When the payments are half-yearly, 4*a* must be divided; when they are quarterly, then 8*a* must be divided as before.

5. If the amount of an annuity, payable half-yearly, for 5 years, at 5 per cent be 389*l* 7*s* 6*d* what is the annuity? Ans. 70*l*.

6. If the amount of an annuity, payable quarterly, for 5 years, at 5 per cent be 391*l* 11*s* 3*d* what is the annuity? Ans. 70*l*.

Case 3.

Q When U, A, and T, are given to find R, how is it discovered?

A. Thus: $\frac{2a-2ut}{utt-ut}=r.$

Examples.

1. If an annuity of 70*l* per ann. amounts to 385*l* in 5 years; I demand the rate per cent? Ans 5*l*

2. If a pension of 56*l* per ann. amounts to 462*l* 11*s* 2*d* 1.6 qr. in 7 years, what is the rate per cent? Ans. 6*l*.

3. If a house be let upon lease for 7 years at 50*l* per ann. and the amount for that time be 392*l* what is the rate per cent? Ans 4*l* per cent.

4. If a salary of 100*l* per annum, being forborn 7 years amount to 794*l* 10*s* I demand the rate per cent? Ans. $4\frac{1}{2}$.

Note. When the payments are half-yearly, then 4a—4ut must be divided; but when they are quarterly, then 8a—8ut must be divided as before.

5. If an annuity of 70*l* per ann. payable half-yearly, being forborn 5 years, amounts to 389*l* 7*s* 6*d* I demand the rate per cent? Ans. 5 per cent.

6. If an annuity of 70*l* per ann. payable quarterly, amounts to 391*l* 11*s* 3*d* in 5 years: I demand the rate per cent? Ans. 5*l* per cent.

CASE 4.

Q. When U, A, and R, are given to find T, how is it discovered?

A. Thus; First 2

$$\frac{}{r}1=x.$$

Secondly, $\sqrt{\frac{2a}{ru}+\frac{xx}{4}}-\frac{1}{2}x=t.$

EXAMPLES.

1 In what time will 70*l* per ann. amount to 385*l* forborn at 5 per cent? Ans. 5 years.

2 In what time will a pension of 56*l* per ann. amount to 462*l* 11*s* 2*d* 1.6 qr at 6 per cent? Ans. 7 years.

3 If a house be let upon lease, for a certain time, for 50*l* per annum and the amount be 392*l* at 4 per cent. I demand the time that is was let for? Ans. 7 years.

4 If a salary of 100*l* per annum being forborn a certain time, amounts to 794*l* 10*s* at $4\frac{1}{2}$ per cent. I demand the time of forbearance? Ans. 7 years.

Note. If the payments were half-yearly then T will be equal to the number of half-years, or payments; but if they were to be made quarterly, then T will be equal to the number of quarterly payments.

5 If an annuity of 70*l* per ann. payable half-yearly, being forborn, amounts to 389*l* 7*s* 6*d* at 5 per cent. I demand the time and payments forborn? Answ. 10 payments=5 years.

6 If an annuity of 70*l* per ann. payable quarterly, being forborn, amounts to 391*l* 11*s* 3*d* at 5 per cent. I demand the time and payments forborn? Answ. 20 payments=5 years.

OF THE PRESENT WORTH OF ANNUITIES, OR PENSIONS, &c.

Note, P represents the present worth; U, T, and R, as in the last.

CASE 1.

Q. When U, T, and R are given to find P, how is it discovered?

Thus; $\frac{rtt-rt+2t}{2rt+2}:\times u=p.$

EXAMPLES.

1 What is the present worth of 50*l* per ann. to continue 6 years at 5 per cent? *Ans.* 259*l* 12*s* 3*d* 2.4+qrs.

2 What is 80*l* yearly rent, to continue 5 years, worth in ready money, at 6 per cent? *Ans* 344*l* 12*s* 3*d* 2+5 qrs.

3 What is a salary of 40*l* per ann. to continue 7 years worth in ready money, at 4 per cent? *Ans.* 245*l*.

4 What is a pension of 30*l* per ann. for 5 years worth in ready money, at $4\frac{1}{2}$ per cent? *Ans.* 133*l* 9*s* 4*d* 2.6+qrs.

Note, Observe the same note here, which is given in case 1, in annuities and pensions in arrears, concerning half-yearly and quarterly payments.

5 What is the present worth of 50*l* per ann. payable half-yearly for 6 years, at 5 per cent? *Ans.* 262*l* 10*s*.

6 What is the present worth of 50*l* per ann. payable quarterly for 6 years, at 5 per cent? *Ans.* 263*l* 18*s* 9*d* 3.6 qrs.

Note. By comparing these two examples with the first, it may be observed, that the present worth of half-yearly payments is more advantageous than yearly payments, and the present worth of quarterly than half yearly payments.

CASE 2.

Q. When P, T, and R, are given to find U, how is it discovered.

A. Thus: $\frac{rt+1}{rtt-rt2+t}:+2p=u.$

EXAMPLES.

1 There is a lease of a house 6 years to come; I demand the yearly rent, when the present worth at 5 per cent is 259*l* 12*s* 3*d* 2.4 qrs. ? *Ans* 50*l* per ann.

2 What yearly rent is that, the present worth of which for 5 years is 344*l* 12*s* 3d 2 qrs. at 6 per cent? Ans. 80*l* per ann.

3 What salary is that which for 7 years continuance at 4 per cent produces 245*l* for the present worth ? Ans. 40*l* per ann.

4 If the present worth of a pension to continue 5 years at $4\frac{1}{2}$ per cent be 133*l* 9*s* $4d\frac{3}{4}$, I demand the pension ? Ans 30*l*.

Note. When the payments to be made are half-yearly, you must multiply by ψ; but when they are quarterly, then multiply by $8p$ to find u.

5 There is a lease of a house, payable half yearly, for 6 years to come, I demand the yearly rent, when the present worth at 5 per cent is 262*l* 10*s* ? *Ans.* 50*l*.

6 There is a lease of a house, payable quarterly, for 6 years to come I demand the yearly rent, when the present worth at 5 per cent is 263*l* 18*s* 9*d* 3.6 qrs? *Ans* 50*l*.

Case 3.

Q. When U, P, and T, are given to find R, how is it discovered? $2ut - \times p$

A. Thus: $\frac{\qquad\qquad}{2pt + ut - utt} = R$

Examples.

1. I demand at what rate per cent will the yearly rent of 50*l* to continue 6 years, produce the present worth of 259*l* 12s 3d 2 qrs.? Ans. 5*l*. per cent.

2. If the yearly rent of 80*l* per annum to continue 5 years, being 344*l*. 12s 3d 2 qrs. present worth, what is the rate per cent? Ans. 6*l* per cent.

3. If a salary of 40*l*. per ann. to continue 7 years, produces 245*l*. for the present worth, what is the rate per cent? Ans. 4*l* per cent.

4. If a pension of 30*l* per annum to continue 5 years produce 133*l* 9s 4d 2 qrs. for the present worth, what is the rate per cent? Ans. $4\frac{1}{2}$*l* per cent.

Note. When the annuities or rents are to be paid half-yearly, or quarterly, then
For half-yearly payments, to take half of the annuity or yearly rents and twice the number of years, that is, reduce the years into half years. and then the quotent of the upper part divided by the lower, will be the Ratio of half the Rate per Cent. But.
For Quarterly payments, take a fourth part of the Annuity, or yearly Rent, and four times the Number of Years; that is, reduce the Years into Quarters; and then the Quotient of the upper part divided by the lower will be the Ratio of a 4th part of the Rate per Cent.

5. A lease of a house of 50*l* per annum payable half-yearly, having 6 years to come, is sold for 262*l* 10s I demand the rate per cent? Ans. 5*l* per cent.

6. A lease of a house of 50*l*. per ann. payable quarterly, having 6 years to come, is sold for 262*l* 18s 9d 3 qrs. I demand the rate per cent? Ans. 5*l* per cent.

Case 4.

Q. When U, P, and R, are given to find T, how is it discovered?

A. Thus: first, $\frac{2}{r} \cdot \frac{2p}{x} - 1 = x$

Secondly, $\sqrt{\frac{2p}{rx} + \frac{xx}{4}} - \frac{r}{2} = t.$

P 2

Examples.

1. If 50*l* yearly rent produces the present worth of 259*l* 12s 8d 2 qrs. at 5 per cent what is the time of its continuance? Ans. 6 years.

2. I demand how long 80*l* per ann. may be purchased for 344*l* 12s 3d 2 qrs. at 6 per cent? Ans. 5 years.

3. How long must a salary of 40*l* per ann. be enjoyed for 245*l* at 4 per cent? Ans. 7 years.

4. What time may a pension of 30*l*. per ann. be bought for 133*l* 9s 4d 2 qrs. at $4\frac{1}{2}$ per cent? Ans. 5 years.

Note 1. If the payments are to be half-yearly, then U will be=half of the given lease, pension, &c. and R will be=half of the Ratio of the given rate, and T which is required, will be=to the number of payments or half-years.

2. If the payments are to be quarterly, then U will be=a fourth part of the given Lease, Pensions, &c. and R will be=a fourth part of the ratio of the given rate, and T will be=the number of the quarterly payments.

5. A lease of an house of 50*l*. per ann. payable half-yearly is sold for 262*l* 10s at 5 per cent, I demand the number of payments and the time to come? Ans. 12 payments=6 ys.

6. A lease of an house of 50*l* per ann. payable quarterly, is sold for 263*l* 18s 9d 3 qrs. at 5 per cent. I demand the number of payments and the time to come? Ans. 24 payments=6 years.

Of Annuities, Leases, &c. taken in Reversion.

Q. How do you find the present worth of an annuity, &c in Reversion.

A. Thus; first find the present worth of the yearly, sum at the given rate, and for the time of its continuance; to do which, there are given U, T, & R, to find P, which is thus discovered:

$$\frac{rtt-r+2t}{2rt+2} : \times u = p$$

Secondly, find what principal being put to interest will amount to P, at the same rate, and for the time to come before the annuity, &c. commences; and that will be the present worth of the annuity &c. in reversion; therefore let P be changed into A=the amount, and then there will be given A, R, and T, to find P, or the principal, which is thus discovered.

$$\frac{a}{tr+1} = p$$

EXAMPLES.

1 What is the present worth of a lease of 30*l* per ann. to continue 3 years, but is not to commence till the end of 2 years, allowing 4 per cent to the purchaser? Ans. 77*l* 7*s* 7.2*d*.

2 I have the promise of a pension of 17*l* per ann. for 7 years, but it does not commence till the end of 4 years and I am willing to dispose of the same for the present payment at the rate of 5 per cent—I demand the present worth? Ans. 84*l* 9*s* 6*d*.

3 There is a legacy of 20*l* per ann. for 8 years, left to a person of 16 years of age; the time of payment is to commence at the year of perfection, *i. e.* at 21 years; but he, wanting a sum of money, is minded to sell the same at 4 per cent—I demand the present worth? Ans. 115*l* 3*s* 0*d* 1.44 qr.

4 A good natured gentleman being minded to bestow a favor upon an unthankful wretch, settled upon him an income of 35*l* per ann. for 12 years to commence five years after such settlement; but he wanting money to follow his extravagancies, sold it at the rate of 10 per cent—I demand how much he received for the present worth? Ans. 197*l* 5*s* 5*d* 1.696 qr.

CASE 5.

Q. How do you find the yearly income of an annuity, &c. in Reversion?

A. Thus: First, find the amount of the present worth of the yearly sum, at the same rate, and for the time before the reversion: to do which, there are given P, T, and R, to find A, which is thus discovered:

$$ptr+p=a$$

Secondly, Find what yearly rent being sold will produce A, for the present worth, at the same rate and for the time of its continuance: and that will be the yearly sum required: therefore change A into P, and then there will be given P, R; and T, to find U, or the yearly sum. Thus:

$$\frac{rt+1}{rtt-rt+2t} :\times 2p=u.$$

EXAMPLES.

1 There is a lease of a house aken for 3 years, but commences not till the end of 2 years; and the lessee would sell the same for 77*l* 7*s* 7.2*d* present payment, al-

lowing 4 per cent to the purchaser; I demand the yearly rent? Ans. 30*l* per ann.

2 I have the promise of a pension for 7 years, which will not commence till the end of four years; and I have disposed of the same for the present payment of 84*l* 9*s* 6*d* allowing 5 per cent to the purchaser; I demand the yearly income? Ans. 17*l*.

3 There is a legacy of a cerrain rate per ann, for 8 years, left to a person of 16 years of age; but the time of payment must not commence till the age of perfection; and the same person wanting a sum of money, sold it for 115*l* 3*s* 0*d*$\frac{1}{2}$ allowing 4 per cent to the buyer; I demand the yearly rate? Ans. 20*l*.

4 A good natured gentleman being minded to bestow a favour upon an unthankful wretch, settled an income upon him for 12 years, at a certain rate per annum to commence 5 years after such settlement; but he wanting money to follow his extravagance, sold it for 197*l* 5*s* 5*d* 2 qrs. allowing 10 per cent to the buyer for the present payment; I demand the yearly value? Ans. 35*l*.

OF SIMPLE INTEREST FOR DAYS.

Q. How do you find the Simple Interest of any sum of Money for any Number of Days?

A Multiply the interest of one pound for one day, at the given rate, by the principal, and by the number of days; the last product is the interest required.

Note. The Interest of one Pound for one Day at

1	*Per Cent.*	*is* = .00002739726
2		*is* = .00005479452
3		*is* = .00008219178
4		*is* = .00010958904
5		*is* = .0001369863
6		*is* = .00016438356
7		*is* = .00019178082
8		*is* = .00021917808
9		*is* = .00024657534
10		*is* = .0002739726

EXAMPLES.

1 What is the interest of 120*l* for 126 days, at 4 per cent? Ans. 1*l* 13*s* 1*d* 2 qrs+.

2 What is the interest of 126*l* for 145 days, at 6 per cent? Ans. 3*l* 0*s* 0*d* 3 qrs+.

3 What is the interest of 100*l* from the 1st of June, 1798, to the 8th of March following, at 5 per cent? Ans. 3*l* 16*s* 11*d* 3 qrs.

4. What is the interest of 200*l* from the 14th of August 1798, to the 19th of December following, at 6 per cent? Ans. 4*l* 4s 1d 3 qrs.+

5. What is the interest of 10*l* for 25 days, at 5 per cent? Ans. 8d.+

6. What is the interest of 40*l* for 40 days, at 4 per cent? Ans. 3s 6d.+

Note. There is another way of answering Questions in interest for Days, which is laid down in Case 7, in Simple Interest, page 67, as appears by the Questions in that Case. The reader may use which he likes best, or both if he pleases.

OF REBATE OR DISCOUNT.

Q. What particular letters are used in Rebate?

A. These:

S, the sum to be discounted.

P, the present worth of that sum due at any time to come.

T, the time before it becomes due.

R, the Ratio, or the rate per cent.

Case 1.

Q. When S, T, and R, are given to find P, how is it discovered?

A. Thus: $\frac{s}{tr+1}=p$

Examples.

1. What is the present worth of 795*l* 11s 2d for 11 months, at 6 per cent? Ans. 754*l* 1s 8d.+

2. What is the present worth of 161*l* 10s for 19 months at 5 per cent? Ans. 149*l* 13s 0d 3 qrs.+

3. If a legacy of 1000*l* is left me the 24th of July, 1798, to be paid on the Christmas-Day following; what must I receive when I allow 6 per cent, for present payment? Ans. 975*l* 3s 0d 3 qrs.+

Case 2.

Q. When P, T, and R, are given to find S, how is it discovered?

A. Thus: $ptr+p=s$

Examples.

1. Suppose I receive 754*l* 1s 8d now for a sum of money due 11 months hence, allowing 6 per cent for present payment; I demand the sum that was due at first? Ans. 795*l* 11s 2d.

2. *There is* a certain debt payable 19 months hence; *but I agree* with the debtor to pay me down 149*l* 13s 0d

$\frac{3}{4}$, and allow him 5 per cent for present payment; I demand how much the debt is? Ans. 161*l* 10s.

3. A legacy was left me the 24th of July, 1798, to be paid on the Christmas-Day following, but I agree with the Executor, and allow him 6 per cent. for the present payment of 975*l* 3s 0d 3 qrs. I demand what the legacy was? Ans. 1000*l*.

Case 3.

Q When S, P, and R, are given to find T, how is it discovered?

A. Thus; $\frac{s-p}{rp} = t$

Examples.

1. The present worth of 755*l* 11s 2d due for a certain time to come, is 754*l* 1s 8d at six per cent. I demand in what time the first sum should have been paid, if no rebate had been made? Ans 11 months.

2. There is 161*l* 10s due at a certain time to come, but I allow 5 per cent to the debtor, for the present payment of 149*l* 13s 0d 3 qrs. I demand when the sum should have been paid without any rebate? Ans 19 months.

3. I have received 975*l* 3s 0d 3qrs. for a legacy of 1000*l* allowing the executor 6 per cent. I demand when the legacy was payable without rebate? Ans. 155 days.

Case 4.

Q. When S, P, and T, are given to find R; how is it discovered? A. Thus; $\frac{s-p}{tp} = r$.

Examples.

1. At what rate per cent will 795*l* 11s 2d payable 11 months hence, produce 754*l* 1s 8d for present payment? Answ. 6 per cent.

2. At what rate per cent will 161*l* 10s payable 19 months hence, produce the present payment of 149*l* 13s 0d 3 qrs.? Answ 5 per cent.

3. Suppose a legacy of 1000*l* is left me the 24th of July, 1781, to be paid on the Christmas-day following; but I agree with the executor for the present payment of 975*l* 3s 0d 3 qrs. I demand the rate per cent allowed for his money? Answ. 6 per cent.

OF EQUATION OF PAYMENTS.

(THE TRUE WAY.)

Q. How is the equated time for the payment of a sum of money due at several times, found out?

A. Thus; 1. find the present worth of each payment for its respective time, as in Rebate, that is;

$$\frac{s}{tr+1}=p.$$

2. Add all the present worths together, and call that sum also P; then is $s-p=d$ the Rebate.

3. $\frac{d}{pr}=e$ is the true equated time.

EXAMPLES.

1. A owes B 200*l* to be paid as follows, viz 100*l* at 2 months; and 100*l* at 4 months: but they agree to have but one payment of the whole, Rebate being made at 6 per cent. I demand the true equated time? Ans. 3 months.

2. A Merchant hath owing him 300*l* to be paid as follows; 50*l* at 2 months, 100*l* at 5 months, and the rest at 8 months; and it is agreed to have but one payment of the whole, Rebate being made at 5 per cent. I demand the equated time? Ans. 5.9796 months.

3. F owes to H 1000*l* whereof 200*l* is to be paid present; 400*l* at 5 months; and the rest at 10 months; but they agree to have but one payment of the whole, at the rate of 4 per cent Rebate; I demand the true equated time? Ans 181 days.

4. A man owes a merchant 1200*l* to be paid as follows; 200*l* down, 500*l* at the end of 10 months; and the rest at the end of 20 months; and they agree to have but one payment of the whole, Rebate at 3 per cent. I demand the true equated time? Ans. 1 year, 11 days.

OF COMPOUND INTEREST.

Q. WHAT particular Letters are used here?

A. These:

P. the Principal.

T. the Time;

R. the amount of 1*l* for 1 year, at any given Rate;

A. the whole amount.

Q. How is the amount of 1*l* for 1 year, at the proposed rate per cent found?

A. Thus: As 100 : 106 :: 1 : 1.06
100 : 105 :: 1 : 1.05

A table of the amount of 1*l* for 1 year.

Rates per Ct.	Amts. of 1l.	Rates per Ct.	Amts. for 1l.
2	1.02	$6\frac{1}{2}$	1.065
3	1.03	7	1.07
$3\frac{1}{2}$	1.035	$7\frac{1}{2}$	1.075
4	1.04	8	1.08
$4\frac{1}{2}$	1.045	$8\frac{1}{2}$	1.085
5	1.05	9	1.09
$5\frac{1}{2}$	1.055	$9\frac{1}{2}$	1.095
6	1.06	10	1.1

CASE 1.

Q. When P, T, and R, are given to find A, how is it discovered?

A Thus; $p \times r^t = a$

Note. R must be involved so many times as the number of years direct, and that will be r^t

EXAMPLES.

1. What sum will 450*l* amount to in 3 years time, at 5 per cent. per ann? Answ. 520*l* 18*s* 7*d* 2 qrs.

2. What will 400*l* amount to in 4 years, at 6 per cent. per ann? Answ. 504*l* 19*s* 9*d* 3.15264 qrs.

3. What will 480*l* amount to in 6 years, at 5 per cent. per ann? Answ. 643*l* 4*s* 11.0178*d*.

4. What is the amount of 500*l* at $4\frac{1}{4}$ per cent. per ann. for 4 years? Answ. 590*l* 11*s* 5d 2.95 +qrs.

CASE 2.

Q. When A, R, and T, are given to find P, how is it discovered?

A. Thus; $\frac{a}{r^t} = p$.

EXAMPLES.

1. What principal must be put to interest, to amount to the sum of 520*l* 18*s* 7*d* 2 qrs, in 3 years, at 5 per cent per ann? Answ. 450*l*.

2. What principal will amount to 504*l* 19*s* 9*d* 3.15264 qrs. in 4 years, at 6 per cent per ann? Answ. 400*l*.

3. What principal will amount to 643l 4s 11.0178d in 6 years, at 5 per cent. per ann? Answ. 480l.

4 What principal will amount to 590*l* 11*s* 5d 3 qrs. in 4 years, at 4 $\frac{1}{4}$ per cent? Ans. 500*l*.

CASE 3.

Q. When P, R, and A, are given to find T, how is it discovered?

A. Thus; $\frac{a}{p}^{t} = r$ { which being continually divided by r, till nothing remains, the Number of those Divisions will be $= t$.

EXAMPLES.

1. In what time will 450*l* amount to 520*l* 18s 7d 2 qrs. at 5 per cent per ann.? Ans. 3 years.

2. In what time will 400l. amount to 504l 19s 9d 3.2 qrs. at 6 per cent. per ann.? Ans. 4 years.

3. In what time will 480*l* amount to 643*l* 4*s* 11.1d. at 5 per cent per ann.? Ans. 6 years.

4. In what time will 500*l* amount to 590*l* 11s 5d 3 qrs. at 4$\frac{1}{4}$ per cent per ann.? Ans. 4 years.

CASE 4.

Q. When P, A, and T, are given to find R, how is it discovered?

A. Thus; $\frac{a}{p}^{t} = r$ { which must be extracted by the rules of extraction; the time given in the question $= t$ shewing the power.

EXAMPLES.

1 At what rate per cent will 450*l* amount to 520*l* 18s 7d 2 qrs. in 3 years? Ans. 5 per cent.

2 At what rate per cent will 400*l* amount to 504*l* 19s 9d 3.2 qrs. in 4 years? Ans. 6 per cent.

3 At what rate per cent will 480*l* amount 643*l* 4s 11. 1d in 6 years? Ans. 5 per cent.

4 At what rate per cent will 500*l* amount 590*l* 11s 5d 3 qrs. in 4 years? Ans. 4$\frac{1}{4}$ per cent.

OF ANNUITIES OR PENSIONS IN ARREARS.

CASE 1.

Note. *U represents the Annuity, Pension, &c. T. R & A. as before.*

Q. When U, T, and R, are given to find A, how is it discovered?

A. Thus; $\frac{ur^{t} - u}{r - 1} = a$

EXAMPLES.

1 What will an annuity of 30*l* per ann. payable yearly

amount to in 4 years, at 5 per cent? Ans. 129*l* 6s 0d 3.6 qrs.

2 Suppose a Pension of 50*l* per ann payable yearly, be granted to a superannuated officer; what is the amount for 5 years forbearance at 4 per cent? Ans. 270*l*. 16s 3d 3.4+ qrs.

3 If the yearly rent of a house which is 40*l* be forborn 7 years, at 6 per cent what is the amount? Ans. 335*l* 15s 0d 3.3+qrs.

4 If a salary of 35*l* per ann. to be paid yearly, be omitted for 6 years at $5\frac{1}{2}$ per cent what is the amount? Ans. 241*l* 1s 7d 2.5+qrs.

Case 2.

Q. When R, T, and A, are given to find U, how is it discovered?

$$\text{Thus; } \frac{ra-a}{\frac{t-1}{r}} = u.$$

1 What annuity, being forborn for 4 years, will amount to 129*l* 6s 1d at 5 per cent? Ans. 30*l* per ann.

2 If a pension being forborn for 5 years, at 4 per cent per ann. amounts to 270*l* 16s 4d 1 demand how much it is per ann.? Ans. 50*l* per ann.

3 If the yearly rent of a house, being forborn for 7 years, at 6 per cent amounts to 335*l* 15s 0d 3.4 qrs. I demand what the rent is? Ans. 40*l* per ann.

4 If the payment of a salary be omitted 6 years; I demand how much the salary is, when the amount is 241*l* 1s 7d 2.6 qrs. at $5\frac{1}{2}$ per cent? Ans. 35*l* per ann.

Case 3.

Q. When U, A, and R, are given to find T, how is it discovered?

A. Thus; $\frac{ar+u-a}{u} = r$ $\left\{\begin{array}{l} t \\ \text{which being continually divided by } r, \text{ till nothing remains,} \\ \text{the Number of those Divisions will be} = t. \end{array}\right.$

Examples.

1 In what time will 30*l* per ann amount to 129*l* 6s 1d allowing 5 per cent for the forbearance of payment? Ans. 4 years.

2 In what time will a pension of 50*l* per ann. amount to 270*l* 16s 4d at 4 per cent? Ans. 5 years.

3 In what time will the yearly rent of a house, being

40*l* per ann. amount to 335*l* 15s 1d at 6 per cent for non-payment? Ans. 7 years.

4 In what time will a salary of 35*l* per ann. amount to 241*l* 1s 7d 2.6 qrs. at $5\frac{1}{2}$ per cent for the forbearance of payment? Ans. 6 years.

Note. *In this and the two next Sections might be placed Case 4; but because it requires an algebraic method of proceeding, in order to find R, I omit inserting it in its place; this being designed to treat only of numbers.*

OF THE PRESENT WORTH OF ANNUITIES, PENSIONS, &c.

Note. *P, is the present worth, U, T, and R, as in the last.*

Case 1.

Q. When U, T, and R, are given to find P, how is it discovered?

$$u - \frac{u}{r^t}$$

A. Thus; $\dfrac{\dfrac{u}{r^t}}{r-1} = p.$

Examples.

1 What is the yearly rent of 20*l* to continue 6 years, worth in ready money, at 5 per cent? Ans. 101*l* 10s 3d.

2 What is the present worth of a pension of 30*l* per ann. for 5 years at 4 per cent? Ans. 133*l* 11s 1d.

3 What must be the discount of a lease of 50*l* per ann. when present payment is made for 4 years at 3 per cent? Ans. 14*l* 2s 10d 2 qrs.

4 A house is let upon lease for 4 years at 70*l* per ann. and the lessee is desirous to make present payment, provided the lessor will allow him $5\frac{3}{4}$ per cent. I demand how much must be paid down, and how much discounted?

Ans. { 243*l* 19s 0d 3 qrs to be paid down.
36*l* 0s 11d 1 qr. to be discounted.

Case 2.

Q. When P, T, and R, are given to find U, how is it discovered?

A. Thus; $\dfrac{\sqrt[t]{pr^t \times r - pr}}{r^t - 1} = u$

EXAMPLES.

1 What annuity or yearly rent, to continue 6 years, may be purchased for 101*l* 10s 3d 3 qrs. at 5 per cent. ? Ans. 20*l*.

2 Suppose the present payment of 133*l* 11s 1d were required for a pension for 5 years to come, at 4 per cent what is that pension ? Ans. 30*l* per ann.

3 If the present payment of 185*l* 17s 1d 2 qrs. be made for the lease of a house, 4 years to come, at 3 per cent. what is the yearly rent? Ans. 50*l* per ann.

4 If a house is let upon lease for 4 years, and the lessee makes present payment of 243*l* 19s 0d 3 qrs for that time at $5\frac{3}{4}$ per cent what is the yearly rent of the house? Ans. 70*l* per ann.

CASE 3.

Q. When U, P, and R, are given to find T, how is it discovered?

A. Thus; $\frac{u}{p+u-pr} = r^t$ which being continually divided by r, till nothing remains, the number of those divisions will be $= t$.

EXAMPLES.

1 How long may a lease of 20*l* yearly rent, be had for 101*l* 10s 3d 3 qrs, allowing 5 per cent to the purchaser? Ans. 6 years.

2 I demand what time a lease of 30*l* per ann. may be purchased for, when present payment of 133*l* 11s 1d is made at 4 per cent? Ans. 5 years.

3 If 185*l* 17s 1d 2 qrs. be paid down for a lease of 50*l* per ann. at 3 per cent how long is the lease purchased for? Ans. 4 years.

4 A house is let upon lease, at 70*l* per ann. and the lessee makes present payment of 243*l* 19s 0d 3 qrs. he being allowed $5\frac{3}{4}$ per cent. I demand how long the lease is purchased for ? Ans. 4 years.

OF ANNUITIES, LEASES, &c. TAKEN IN REVERSION.

CASE 1.

Q. How many operations are there in case 1?

A. Two.

Q. What is the first ?

A. Find the present worth of the yearly sum at the given rate, and for the given time of its continuance; to do which there are given U, T, and R, to find P.

Q. How is P discovered?

$$u - \frac{u}{r^t}$$

A. Thus; $\frac{u}{r^t - 1} = p.$

Q. What is the Second?

A. find what principal being put to interest will amount to P, at the same rate, and for the time to come before the annuity commences, and that will be the present worth of the annuity, &c. in Reversion; therefore let P be changed into A=the amount, and then there will be given A, R, and T, to find P, or the principal.

Q. How is P discovered?

A. Thus; $\frac{a}{r^t} = p.$

EXAMPLES.

1 What is the present worth of the Reversion of a Lease of 20*l* per ann. to continue 4 years, but not to commence till the end of two years allowing 5 per cent. to the purchaser? Ans. 64*l* 6s 6d 1.4+qrs.

2 There is a Lease of certain lands worth 32*l* per ann. which is yet in being 4 years; and the Lessee is desirous to take a Lease in Reversion for 7 years, to begin when the old Lease shall be expired; I demand the present worth of the said Lease in Reversion, allowing 5 per cent to the purchaser? Ans. 152*l* 6s 8d 2 qrs.+

3. There is a house now building, which I have a mind to take a Lease of for 8 years; but the house will not be finished within 2 years: I demand how much I must pay down, when the yearly rent is 100*l* and the landlord allows me 4 per cent on present payment? Ans. 622*l* 9s 7d.

CASE 2.

Q. How many Operations are there in Case 2?

A. Two.

Q. What is the First?

A. Find the amount of the present worth of the yearly *sum at the given* rate, and for the time before the annuity *commences*, to do which there are given P, R and T, to find A.

Q. How is A discovered?

A. Thus; $\overset{t}{pr}=a$.

Q. What is the second?

A. Find what yearly rent being sold will produce A for the present worth, at the same rate, and for the time of its continuance; and that will be the yearly sum required: therefore let A be changed into P, and then there will be given P, R, and T, to find U, or the yearly sum.

Q. How is U discovered?

A. Thus; $\frac{\overset{t}{pr}\times r-\overset{t}{pr}}{rt-1}=u$.

EXAMPLES.

1 What annuity or yearly rent to be entered upon 2 years hence, and then to continue 4 years, may be purchased for 64*l* 6s 6d 2 qrs. ready money, at 5 per cent? Ans. 20*l*.

2 There is a Lease of certain lands in being for 4 years, and the Lessee being minded to take a Lease in Reversion for 7 years, to begin when the old Lease shall be expired, laid down 152*l* 6s 8d. 2 qrs. I demand the yearly rent of the said Lands, when allowance was made to the Lessee, at 5 per cent.? Ans. 32*l* per ann.

3 The present payment for the Lease of a house is 622*l* 9s. 7. 2d. Now I have taken a Lease in Reversion for 8 years, which is to commence at the end of 2 years; I demand how much the yearly rent is, when for the said present payment I was allowed 4*l* per cent? Ans. 100*l* per ann.

CASE 3.

Q. How many operations are there in Case 3?

A Two.

Q. What is the First?

A. Find the amount of the present worth of the yearly sum at the given rate, and for the time before the annuity, &c. commences; to do which there are given P, R, and T, to find A, as in Case 2.

Q. How is A discovered?

A. Thus; $\overset{t}{pr}=a$.

Q. What is the second operation?

A. Find what time the yearly rent given being sold for will produce A for the present worth, at the same rate, and that will be the time required: therefore change A into P, nd then there will be given U, P, and R, to find T, as in Case 3, page 194.

Q. How is T discovered?

A. Thus; $\frac{u}{fu+u-fr.}=r^{t}$ which being continually divided by r till nothing remains, the Number of those Divisions will be $=t$.

EXAMPLES.

1 The present worth of a certain Lease in Reversion is 64*l* 6s 6d $\frac{1}{2}$ the Lease is 20*l* per ann. and commences 2 years hence, and the allowance to the purchaser is 5 per cent. I demand the time of its continuance? Ans. 4 years.

2 A certain man took a Lease of some Lands, for a time, which by agreement was not to commence till the expiration of 4 years; the yearly rent was 32*l*. it was agreed, that the purchaser should lay down 152*l*. 6s 3d $\frac{1}{2}$, and be allowed for his present pay 5 per cent I demand the time that the Lease was taken for? Ans. 7 years.

3 The present payment for the Lease of a house is 622*l* 9s 7.2d. and the yearly rent is 100*l*. Now I have taken a lease in reversion, which is to commence at the end of two years; I demand the length of the lease, when I was allowed 4 per cent. for my Money? Ans. 8 years.

OF PURCHASING REAL OR FREEHOLD ESTATES.

Q. What do you understand by a Real or Freehold estate?

A. Such as is bought to continue forever.

Note. *U represents the yearly rent; R, the amount of* 1*l. &c. and P the present worth.*

CASE 1.

Q. When U, and R, are given to find P, how is it discovered?

A. Thus; $\frac{u}{r-1}=fu.$

EXAMPLES.

1 Suppose a Freehold Estate of 40*l*. per ann. is to

sold, what is it worth, allowing the buyer 5 per cent. for his money? Ans 800*l*.

2 What is an Estate of 290*l* per ann. to continue for ever worth in present money, allowing 4 per cent. to the Buyer? Ans. 7250*l*

CASE 2.

Q. When P, and R, are given to find U, how is it discovered?

A. Thus; $\sqrt{p \times r - 1} = u$.

EXAMPLES.

1 If a Freehold Estate is bought for 800*l* and the allowance of 5 per cent. is made to the buyer; I demand the yearly rent? Ans 40*l* per ann.

2 If an estate be sold for 7250*l* present money, and 4 per cent. is allowed to the buyer for the same; I demand the yearly rent? Ans. 290*l* per ann.

CASE 3.

Q. When P, and U, are given to find R, how is it discovered?

A. Thus; $\frac{p+u}{p} = r$.

EXAMPLES.

1 If a real estate of 40*l* per ann. be sold for 800*l*. I demand the rate per cent.? Ans. 5 per cent.

2 If a Freehold Estate of 290*l*. per ann. be bought for 7250*l*. I demand the rate per cent. allowed? Ans. 4 per cent.

OF PURCHASING FREEHOLD ESTATES IN REVERSION.

CASE 1.

Q. How many operations are there in Case 1.

A. Two.

Q. What is the First?

A. Find the present worth of the yearly sum at the given rate, to which there are given U, and R, to find P.

Q. How is P discovered?

A. *Thus*: $\frac{u}{r-1} = p$.

Q. *What* is the second operation?

A. *Find* what principal being put to interest will

amount to P, at the same rate, and for the time to come before the estate commences, and that will be the present worth of the estate in Reversion: therefore let P be changed into A=the amount, and then there will be given A, R, and T, to find P=the principal.

Q. How is P discovered?

A. Thus; $\frac{a}{t}$ p.

r

EXAMPLES.

1. Suppose a Freehold Estate of 40*l* per ann. to commence 3 years hence, is to be sold, what is it worth, allowing the purchaser 5 per cent. for his present payment? Ans. 69 *l*. 1s 4d 3 qrs. +

2 What is an Estate of 290*l* per ann. to continue for ever, but not to commence till the expiration of 4 years, worth in present money, allowance being made at 4 per cent.? Ans. 6197*l*. 6s 7d 2 qrs. +

CASE 2.

Q. How many operations are there in case 2?

A. Two.

Q. What is the First?

A. Find the amount of the present worth of the yearly rent, at the given rate, and for the time before the estate commences; to do which there are given P, T, and R, to find A.

Q. How is A discovered?

A. Thus; $pr^t=a$

Q. What is the second operation?

A. Find what yearly rent being sold will produce A for the present worth, at the same rate, and that will be the yearly sum required: therefore let A, be changed into P, and then there will be given P, and R, to find U, or the yearly sum.

Q. How is U discovered?

A. Thus; $\frac{\sqrt{pr\times r-pr}}{r}=u$

EXAMPLES.

1. Suppose a Freehold estate, to commence 3 years hence, is sold for 69*l*. 1s 5d allowing to the purchaser 5 *per cent. I* demand the yearly income? Ans. 40*l*. per annum.

2. There is a certain Freehold Estate bought for 6197*l.* 6s 5d 2 qrs. which does not commence till the expiration of 4 years; the buyer was allowed 4 per cent. for his money; I demand the yearly income? Ans. 290*l.* per ann.

OF REBATE OR DISCOUNT.

Q. What particular Letters are used here?

A. These:

S. the sum to be discounted for.

P. the present worth of that sum, due at any time to come.

T. the time before it becomes due, and

R. the amount of 1*l.* for 1 year, at any rate per cent.

Case 1.

Q. When S, T, and R, are given to find P, how is it discovered?

A. Thus; $\frac{s}{t\ r} = p$.

Examples.

1. What is the present worth of 520*l.* 18s. 7d. 2 qrs. payable 3 years hence, at 5 per cent.? Ans. 450*l.*

2. There is a debt of 504*l.* 19s. 9d. 3 qrs. which is not due until 4 years hence; but it is agreed to be paid in present money; what sum must the Creditor receive; allowing the Rebate of 6 per cent. to the Debtor for his money? Ans. 400*l.*

3. If 643*l.* 4s. 11d. be payable in 6 years time, what is the present worth, Rebate being made at 5 per cent.? Ans. 480*l.*

Case 2.

Q. When P, T, and R, are given to find S, how is it discovered?

A. Thus; $p + \overset{t}{r} = s$.

Examples.

1. If 450*l.* be received for a debt, payable 3 years hence, and an allowance of 5 per cent. was made to the debtor for his present payment; I demand what the debt was? Ans. 520*l.* 18*s.* 7d. 2 qrs.

2. *There* is a sum of money, due at the expiration of 4 *years, but* the Creditor agrees to take 400*l.* down, allow-

ing 6 per cent. on present payment; I demand what the debt was? Ans. 504*l.* 19s. 9d. 3 qrs.

3. If a sum of money, due 6 years hence, produces 480*l.* for present payment, Rebate being made at 5 per cent. I demand how much the debt was? Ans. 643*l.* 4s. 11d.

Case 3.

Q. When S, P, and R, are given to find T, how is it discovered?

A. Thus; $\frac{s}{p}=r^{t}$ { which being continually divided by r, till nothing remains, the number of those divisors will be $=t$.

Examples.

1. A certain man received 450*l.* down for a debt of 520*l.* 18s. 7d. 2 qrs. Rebate being at 5 per cent. I demand in what time the debt was payable? Ans. 3 years.

2. There is a debt of 504*l.* 19s. 9d. 3 qrs. payable at a certain time; but it is agreed to pay 400*l.* down, at the allowance of 6 per cent. to the debtor for his present money: I demand in what time the debt will become due, if no such payment was to be made? Ans. 4 years.

3. The present payment of 480*l.* is made for a debt of 643*l.* 4s. 11d. Rebate at 5 per cent. I demand when the debt was payable? Ans. 6 years.

Case 4.

Q. When S, P, and T, are given to find R, how is it discovered?

A. Thus; $\frac{s}{p}=r^{t}$ { which must be extracted by the rules of extraction; the time given in the questions $=t$, shewing the power.

Examples.

1. The present worth of 520*l.* 18s. 7d. 2 qrs. payable 3 years hence, is 450*l.* I demand at what rate per cent. Rebate is made? Ans. 5 per cent.

2. A debt of 504*l.* 19s. 9d. 3 qrs. will be due 4 years hence; but it is agreed to take 400*l.* down; what is the rate per cent. that the Rebate is made at? Ans. 6 per cent.

3. The sum of 643*l.* 4s. 11d. is payable in 6 years time; and the present worth of that sum is 480*l.* I demand at what rate per cent. must Rebate be made, to produce the said present worth? Ans. 5 per cent.

Note 1. *Equation of payments or Compound Interest, should follow next; but as that rule is best done by the Logarithms, the kind reader will, I hope, take this as a sufficient reason for not placing it here.*

2. *The whole business of Compound Interest, is better performed by the Logarithms, or by Tables calculated for that purpose, than otherwise: especially when the time given is very long, as for 20, 30 or 40 years, and when teh payments are to be made half yearly or quarterly. What is here done serves only for whole years, and shews what can be done by the pen, where the Logarithms or tables are wanting.*

A practical and easy Method to cast up the Value of Timber.

Rule. Multiply the Number of Feet by the Price (in Shillings) per Load, and cut off 3 places to the right hand, which makes pounds and Decimal Parts thereof.

EXAMPLES.

754 Feet at 1*l.* 7*s.* 6*d.* per Load

754
27

20358
+377

20735

754 at 6*d.* = 377

l. s. d.
20 735 = 20 14 9$\frac{6}{8}$

856 Feet at 1*l.* 6*s.* per load
Facit 22*l.* 5*s.* 1*d.*$\frac{1}{2}$

730 feet at 1*l.* 8*s.* 6*d.* per load,
Facit 20*l.* 16*s.* 1*d.*

433 feet at 1*l.* 3*s.* 6d. per load,
Facit 10*l.* 3*s.* 6d.

Demonstration. 50 Feet make a Load; therefore it is, as 50 Feet . . Price in Shillings : : Feet given . . Value in Shillings, which ÷ 20 are Pounds: But as 50 × 20 = 1000 which is a Divisor for Pounds; therefore the 1st Figure being 1, and the rest Cyphers, Division is made at once, by pointing off three places as above.

THE

SCHOOLMASTER'S

ASSISTANT.

PART IV.

A COLLECTION OF QUESTIONS TO EXERCISE THE FOREGOING RULES.

1. WRITE down nine hundred millions, seven hundred sixty thousand, and twenty-one.

2. What must 20s pay towards a tax, when 326*l* 6s 8d is assessed at 41*l* 16s 2d? Ans 2s 6d 2 qrs. $\frac{7760}{78530}$.

3. If the $\frac{1}{3}$ of 6 be 3, what will the $\frac{1}{3}$ of 20 be? Ans. $7\frac{1}{2}$.

4. I demand the sum of 1748 added to itself? Ans. 3496.

5. I demand the product of 76 multiplied by itself? Ans. 5776.

6. I demand the difference between 14676 and the fourth of itself? Ans. 11007.

7. I demand the quotient of the square of 476 divided by the half of its root? Ans. 952.

8. There is, in 3 bags, the sum of 1468*l* viz. in the first bag 461*l* in the second 581*l* I demand what is in the third bag? Ans. 426*l*

9. What number is that which being multiplied by 13, the product will be 221? Ans. 17.

10. Two persons, A, and B, owe several debts; the lesser debt, being that of A, is 2173*l* the difference is 371*l* what is the debt of B? Ans 2544*l*.

11. A captain and 160 sailors took a prize worth 1360*l* of which the captain had $\frac{1}{5}$ for his share, and the rest was equally divided among the sailors; what was each man's part? Ans. the captain had 272*l* and each sailor had 6*l* 16s.

12 An ancient lady being demanded how old she was; to avoid a direct answer, said, I have 9 children, and there are 3 years between the birth of each of them; the eldest was born when I was 19 years old, which is now exactly the age of the youngest: how old was the lady? Ans. 62 years old.

13. What number is that from which if you take 341, the remainder will be 726? Ans. 1067.

14. What number is that which being added to 168 makes the sum to be 706? Ans. 538.

15 What number is that which being divided by 19, the quotient will be 72? Ans. 1368

16. A broker bought for his principal, in the year 1720, 400*l* capital stock in the South Sea, at 650 per cent and sold it again when it was worth but 130 per cent how much was lost in the whole? Ans. 2080*l*.

17. The sum of two numbers is 4139, their difference is 948; what is the lessor number? Ans. 3191.

18. A gentleman went to sea at 17 years of age; 8 years after that he had a son born, who lived 46 years, and died before his father; after whom the father lived twice 20 years, and then died also; I demand the age of the father when he died? Ans. 111 years.

19. Three gardeners, A, B, and C, having bought a piece of ground, find the profits of it amount to 120*l* per ann. Now the sum of money which they laid down was in such proportion, that as often as A paid 5*l* B paid 7*l* and as often as B paid 4*l* C paid 6*l*. I demand how much each man must have per annum of the gain?

B		A		B		A
7	:	5	::	4	:	$2\frac{6}{7}$
A		C		A		C
$2\frac{1}{6}$	:	6	::	5	:	$10\frac{1}{2}$

Answ.		*l.*	*s.*	*d.*
	A	26	13	4
	B	37	6	8
	C	56	0	0
		120	0	0

20. A, B, and C, freight a ship with wine, viz. A lays out 1342*l* B 1178*l* C 630*l* the whole 212 tuns, are sold at 32*l* per tun; what shall each man receive?

Answ.		*l.*	*s.*	*d.*	*qrs.*
	A	2890	3	11	$3\frac{120}{3150}$.
	B	$2537\frac{2}{3150}$			
	C	1356	16	0	

21. A, B, and C, made up a stock of 1000*l* whereof A put in 409*l* B 198*l* and they improved it to 1964*l*. I demand what was the stock of C, and what was each man's share of the whole gain?

Answ.				
C's stock was	393	0	0	
A's share was	803	5	$6\frac{240}{1000}$	
B's - - -	388	17	$5\frac{280}{1000}$	
C's - - -	771	17	$0\frac{480}{1000}$	

22. *A, B,* and C, freight a ship for the Canaries, worth

3696*l* whereof A puts in 369*l* B 897*l* but by reason of a storm, one third of the goods were cast over-board; I demand each man's share of the loss? Ans. A's loss was 123*l* B's 299*l* and C's 810*l*.

23. A and B traded together, and gained 100*l* A put in 640*l* B put in so much that he must receive 60*l* of the gain; I demand how much B put in? Ans. 960*l*

24. What is the value of 27 dozen, and 10*lb* of candles, at 5d per *lb*? Ans. 6*l* 19s 2d.

25. Bought 28 qrs. 2 bushels of wheat, at 4s 6d per bushel; what is the worth of it? Ans. 50*l* 17s.

26. If a man earns 2s 6d 2 qrs per day, how much is that for 19 weeks, Sundays excepted? Ans. 14*l* 9s 9d.

27. A, B, and C, traded together, the first laid in I know not how much; B put 20 pieces of cloth; and C put in 500*l* and they have gained 1000*l* whereof A ought to have 350*l* and B 400*l* I demand C's share, how much the first man laid in, and what the 20 pieces of cloth were worth? Ans. C's share was 250*l* A laid in 700*l* and B's cloth was worth 800*l*.

28. A merchant buys up six bags of Canterbury hops No. 1, of which weighed 3 C 3 qrs 20*lb*. No. 2, 3 C 2 qrs. 26*lb*. No. 3, 3 C 0 qrs 24*lb*. No. 4, 3 C 3 qrs only. No. 5, 2 C 2 qrs 22*lb*. No. 6, 2 C 2 qrs 26*lb* besides 5 pockets, 3 of which weighed 76*lb* $\frac{3}{4}$ each, and the other two 62*lb* $\frac{1}{4}$ each, how many Cwt has he to pay carriage for? Ans. 23 C 0 qrs 24$\frac{3}{4}$*lb*.

29. How many ducats must I deliver at Venice, to receive at London 178*l* 2s the exchange being at 4s 4d per ducat? Ans. 822 ducats.

30. A traveller would change 500 French crowns at 4s 6d per crown, into sterling money, but he must pay a half-penny per crown, for change; how much must he receive. Ans. 111*l* 9s 2d.

31. When a factor taketh 1*l* per cent for his commission, what must he have for 743*l* 17s 3d? Ans. 7*l* 8s 9d 1 qr $\frac{192}{1000}$.

32. Two merchants in company gained 100*l* A laid in so much, that for his share of the gain he must have 60*l* B laid in 720 ducats at 6s 8d per ducat; I demand how much A laid in, and what the ducats were worth? Ans. A laid in 360*l* and the ducats were worth 240*l*.

33. There were two merchants who traded in company; the first laid in the sum of 640l and took $\frac{5}{8}$ of the

gain: I demand how much the second merchant laid in? Ans. 384*l*.

34. What number is that which being multiplied by 12, the product will be $\frac{3}{4}$? Ans. $\frac{1}{20}$.

35. I demand the $\frac{1}{5}$ of 20 shillings? Ans. 12s 6d.

36. What fraction is that, to which if you add $\frac{2}{3}$, the sum will be $\frac{5}{8}$? Ans. $\frac{1}{3}\frac{3}{8}$.

37. What number is that to which if you add $7\frac{2}{3}$, the whole will be $12\frac{1}{4}$? Ans. $4\frac{7}{12}$.

38. What number is that from which if you take $\frac{3}{5}$, the remainder will be $\frac{1}{6}$? Ans. $\frac{5}{10}$.

39. What number is that, from which if you take $13\frac{1}{2}$, the remainder will be $5\frac{5}{7}$? Ans. $19\frac{5}{14}$.

40. What number is that, which being divided by $\frac{3}{4}$, the quotient will be 21? Ans. $15\frac{3}{4}$.

41. What number is that, which being multiplied by $\frac{2}{3}$, produceth $\frac{1}{4}$? Ans. $\frac{3}{8}$.

42. What number is that, from which if you take $\frac{2}{3}$ of itself, the remainder will be 12? Ans. 20.

43. What part of 25 is $\frac{5}{8}$ of an unit? Ans. $\frac{1}{40}$.

44. What number is that, to which if you add its own $\frac{2}{3}$, the whole shall be 20? Ans. 12.

45. What number is that, which maketh 9 to be $\frac{3}{5}$ of it? Ans. $13\frac{1}{2}$.

46. If a cannon may be discharged at twice with 6*lb* of powder; how many times will 7 C 3 qrs 17*lb* discharge the same piece? Ans. 295 times.

47. If $\frac{3}{8}$ of a ship be worth 3740*l* what is the whole worth? Ans. 9973*l* 6s 8d.

48. A young man received 210*l* which was $\frac{2}{3}$ of his elder brother's portion; now three times the elder brother's portion was half of the father's estate; I demand how much the estate was? Ans 1890*l*.

49. A factor bought a certain quantity of broad cloth, and drugget, which together cost him 81*l* the quantity of broad cloth that he bought was 50 yards, at 18s per yard; and for every five yards of broad cloth he had 9 yards of drugget; I demand how many yards of drugget he had, and how much the drugget cost him per yard? Ans. 90 yards of drugget at 8s per yard.

50. A certain usurer lent out 90*l* for 12 months, and received principal and interest 95*l* 8s. I demand at what rate *per cent* he received interest? Ans 6*l* per cent.

51. *Two men* depart both from one place, the one goes

north and the other south ; the one goes 7 miles a day, and the other 11 miles a day ; how far are they distant the 12th day after their departure ? Ans. 216 miles.

52. A merchant bought 8 tons of wine, which having received damage, he sold for 400*l* and 12 per cent loss ; I demand how much it cost him per tun, and how he sold it per gallon, to lose after the said rate ?

Ans. { Cost - 56*l* 0s 0d per tun.
{ Sold at 0*l* 3s 11d 2qrs $\frac{960}{2016}$ per gallon.

53. Two men depart both from one place, and both go the same road ; the one travels 12 miles every day, the other 17 miles every day : how far are they distant the 10th day after their departure ? Ans. 50 miles.

54. If a gentleman hath an estate of 1000*l* per annum, how much may he spend one day with another, to lay up threescore guineas at the years end ? Ans. 2*l* 11s 4d $\frac{40}{365}$.

55. 76*lb* of cinnamon cost 40*l* 10s 8d and 1 cwt of nutmegs 59*l* 14s 8d. I demand the price of 3 oz one with another ? Ans. 2s.

56. A grocer delivered 17 C 3 qrs 10 lb of tobacco in the roll, to be cut and dried, and when it came home, it held out 16 C 0qrs 14lb. I demand how much was lost in every lb ? and also supposing it cost in the roll 8d $\frac{6}{7}$ per lb. and the cutting 1d $\frac{5}{8}$ per lb. I demand what it now stands him in ?

Ans. { Loss per lb 1 oz 8 dr $\frac{1200}{1993}$.
{ It stands him in 87*l* 5s 3d 1qr $\frac{16}{56}$.

57. If tallow be sold for 4d per lb what is the value of 3 tubs, each 3 C 1 qr 10 lb gross ; tare per tub 25 lb ? Ans. 17*l* 9s.

58. Shipped from Spain 10 tuns of wine, at 10*l* sterling per hhd ; paid custom at the port of London 1s per gallon ; the charges for lighterage, cartage, and porterage, amounted to 5*l* ; afterwards by the misfortune of a pipe staving, containing 126 gallons, I lost 59 gallons : the next day 28 gallons more run out, and the remainder of the pipe not being saleable, I threw it away. The market price not running high, I sold the rest for 17*l* per hhd I demand now much I gained or lost by the sale of the said wine ? Ans. Gained 115*l*.

59. A ship's company took a prize of 300*l* which is to be divided among them as parties, according only to *their pay, and the* time they have been on board ; the of-

ficers and midshipmen 5 months, and the sailors 3 months. The officers, one with another, had 40s per month. The midshipmen 30s per month, and the sailors 22s. There were 6 officers, 12 midshipmen, and 84 sailors; what must each party have of the prize, and what each single person?

Answ.		*l.*	*s.*	*d.*	*qr.*		*l.*	*s.*	*d.*	*qr*
	The officers	144	4	7	$1\frac{224}{416}$	each man.	24	0	9	0+
	Midshipmen	108	3	5	$2\frac{64}{176}$	each man.	9	0	3	1+
	Sailors -	47	11	11	$0\frac{192}{416}$	each man.	0	11	3	3+

60. If 1000lb of beef serve 240 men 8 days, how many lb will serve 460 men 10 weeks? Answ. 16770 lb 13 oz $\frac{640}{1920}$.

61. What is the amount of 1000*l* for 5 years and an half, at $4\frac{3}{4}$ per cent simple interest? Ans. 1261*l* 5s.

62. Sold goods amounting to the value of 700*l* for two 4 months; what is the present worth at 5 per cent simple interest? Ans. 682*l* 19s 5d 2qrs.

64. A merchant bought 400 cloths, at 12*l* per cloth, which he shipped for Spain, to have returns from thence the one half in wine, at 30*l* per tun, and the other half in rice, at 28s per cwt. I demand how much of each must be returned for the cloth? Ans. 80 tuns of wine, and 1714 C 1qr 4 *lb* of rice?

64. A tobacconist hath several sorts of tobacco, viz. of 12d per lb, of 16d per lb, of 18d per lb, and of 2s per lb; and he is desirous to make a mixture of an cwt worth 20d per lb. I demand how much of each must be taken?

	lb.	*oz.*	*d. per lb.*
Answ.	17	$3\frac{18}{26}$	at 12
	17	$3\frac{18}{26}$	at 16
	17	$3\frac{18}{26}$	at 18
	60	$4\frac{224}{26}$	at 24

65. A brewer mixed 17 gallons of ale, at 8d per gallon, with 19 gallons at 10d per gallon, and with 40 gallons at 6d per gallon. I demand what 1 gallon of this mixture is worth; and also the worth of the whole quantity?

Answ. 0*l* 0s 7d 1 qr $\frac{80}{176}$ per gallon.
2*l* 7s 2d the price of the whole mixture.

66. There are two numbers, the one 48, the other twice as much; I demand the difference between their sum and difference? Ans. 96.

67. There are two numbers, the one 63, the other half as much: I demand the product of their squares, and the difference of their product and sum?

Ans. { Product of the squares 3938240.25
Difference - - - - - 1890

68. There are two numbers, the one 25, the other the square of 25; I demand the square root of the sum of their squares? Ans. 625.4998+

69. There are two numbers whose product is 1058, and multiplicand 46; I demand the multiplier, the sum of their factors, and the difference between the sum of the cubes of the factor, and the squares of the product?

Ans. { Multiplier - 23.
Sum of the factors 69.
Difference - 1009861.

70. There are two numbers, whose dividend is 1216, and the quotient 76; I demand the divisor; the difference between the cube of the quotient and the sum of the squares of the divisor and dividend; and the cube-root of the sum of the cubes of the divisor, dividend, and quotient?

Ans. { Divisor - - - 16.
Difference 1039936.
Cube-root - 1216.

71. Two men set out at the same time from the same place but go contrary ways, and they travel each of them 34 miles a day: I demand the time in which they will have travelled 2000 miles? Ans. 29 days, 9 hours, 52 minutes, $\frac{6}{11}$.

72. Six rogues, viz. A, B, C, D, E, and F, having entered into a confederacy, do agree to divide whatever sums of money they shall at any time take upon the highways, according to their valor, that is, in proportion to the number of scars they should then have on their faces: now the first two, viz. A and B, being very bold and daring fellows, had received A 20, and B 19 scars. The next two, viz. C and D having a less share of courage, and not caring to stand all brunts, had each of them but 9 scars; but the other two, viz. E and F, being mere cowards, always turned their backs at the least opposition, and so by chance they had one a-piece; and they having, at several times stolen the sum of 700*l* 13s. do desire to know how they *must divide* it?

		l.	*s.*	*d.*	*qrs.*
Ans.	A must have	237	10	2	0 $\frac{8}{19}$
	B - - - - - -	225	12	7	3 $\frac{12}{19}$
	C - - - - - -	106	17	6	3 $\frac{10}{19}$
	D - - - - - -	106	17	6	3 $\frac{10}{19}$
	E - - - - - -	11	17	6	0 $\frac{2}{19}$
	F - - - - - -	11	17	6	0 $\frac{2}{19}$

73. There are three numbers, 17, 19, and 48; I demand the difference between the sum of the squares of the first and last, and the cube of the middlemost? Ans. 4266.

74. In 7 cheeses, each weighing 1 C 2 qrs 5 lb. how many allowances for seamen may be cut, each weighing 5 oz 7 dr? Ans 3563$\frac{35}{87}$ allowances.

75. In 81034 rundlets of brandy, each 18 gallons, how many gross of bottles, each $\frac{3}{5}$ of a quart? Ans. 45581 gross, 7 doz 6 bottles.

76. In 731 dozen bottles of wine, each 1$\frac{5}{7}$ pint, how many hhds? Ans. 29 hhds 52 gals 5 pints $\frac{5}{7}$.

77. Sold 8 C $\frac{1}{2}$ of steel at 12d per lb. how much flemish money at 33s 8d per pound sterling, am I to receive for the same? Ans. 80*l* 2s 6d$\frac{96}{240}$ flemish.

78. If 48 taken from 120 leave 72, and 72 taken from 91 leave 19, and 7 taken from thence leave 12; what number is that, out of which when you have taken 48, 72, 19, and 7 leave 12? Ans. 158.

72. A hath $\frac{1}{4}$ of a ship, B$\frac{1}{4}$, C$\frac{1}{16}$, D$\frac{3}{16}$; the master clears 120*l*; how much must each owner have?

Ans.	A must have	60*l*	0s.
	B - - -	30	0
	C - - -	7	10
	D - - -	22	10

80. A gentleman having 50s to pay among his laborers for a day's work, would give to every boy 6d. to every woman 8d. and to every man 16d. the number of boys, women, and men, was the same; I demand the number of each? Ans. 20 of each sort.

81. A gentleman had 7*l* 17s 6d to pay among his laborers; to every boy he gave 6d to every woman 8d. and to every man 16d. and there were for every boy, three women and for every woman two men; I demand the number of each? Ans. 15 boys, 45 women, 90 men.

82. Admit a tax of 39*l* is laid on a town for the building of a bridge, and the value of the town rent is 900*l* per ann.

what shall a man pay towards it, whose income is worth 100*l* per ann? Ans. 4*l* 6s 8d.

83. Suppose A hath an estate of 53*l* per ann. pays 5s 10d to a subsidy; what shall B pay, whose estate is worth 100*l* per ann? Ans. 11s 0d $\frac{4}{53}$.

84. If 136*l* are to be divided between two men, so as the lesser share may have such proportion to the greater as 2 to 5, what must each man have?

		l.	*s.*	*d*	*qrs.*
Ans.	One must have	38	17	1	$2\frac{6}{7}$
	The other -	97	2	10	$1\frac{1}{7}$

85. There are 1000*l* to be divided among 3 men, in such a manner, that if A have 3*l* B shall have 5*l* and C 8*l* how much must each man have?

		l.	*s.*
Ans.	A must have	187	10
	B	312	10
	C	500	0

86. Ship'd for Jamaica 550 pair of stockings, at 11s 6d per pair, and 460 yards of stuff, at 14d. per yard; in return for which I had 46 C 3qrs of sugar, at 24s 6d per C and 1570*lb* of indigo, at 2s 4d per *lb*; what remains due to me of my adventure? Ans. 102*l* 12s 11d 2 qrs.

87. If one pound ten, and forty groats
Will buy a load of hay;
How many pounds with nineteen crowns
For twenty loads will pay? Ans. 38*l* 11s 8d.

88. A man driving his geese to the market, was met by another, who said good-morrow, master, with your hundred geese. Says he, I have not an hundred; but if I had half as many as I now have, and two geese and an half, beside the number I have already, I should have an hundred: how many had he? Ans. 65.

89. If a tower 384 feet high from the foundation, and a sixth part be under the earth, and an eighth part under the water; how much in height is visible? Ans. 272 feet.

90. A merchant would lay out in spices 560*l* at the following prices, viz. cloves at 4s per lb mace at 7s. cinnamon at 3s nutmegs at 12s and pepper at 2s per lb and he would have an equal quantity of each sort; I demand that quantity? Ans. 400lb of each sort.

91. The computed distance between London and York *is 150 miles:* now if a man sets out from London, and

walks every day towards York 20 miles, and back again towards London 15 miles; how long will it be before he gets to his journey's end? Ans. 30 days.

92. Bought 127 pieces of cloth, for which I delivered 3589 ells of holland, at 7s 11d per ell English, what cost a piece of that cloth? Ans. 11*l* 3s 8d 2 qrs $\frac{94}{127}$.

93. The account of a certain school is as follows, viz. $\frac{1}{15}$ of the boys learn geometry, $\frac{3}{8}$ learn grammar, $\frac{3}{10}$ learn arithmetic, $\frac{3}{20}$ learn to write, and 9 learn to read; I demand the number of each? Ans. 5 geometers, 30 grammarians, 24 arithmeticians, 12 writers, and 9 readers.

94. I have laid out for a merchant 638*l* 17s 3d. he allows me $2\frac{3}{4}$ per cent. before that I owed him 184*l* 17s 9d. how much is he indebted to me? Ans. 471*l* 10s 10d 1 qr.

95. Bought a tun of wine for 78*l* 17s. at what price must I sell it per quart to gain 5*l* 10s. by the whole, when there were 22 gallons leaked out? Ans. 22d. +

96. If out of 10s per week I lay up 4d 2qrs per day, Sundays excepted; and have saved 9*l* 2s 3d. how long was I in laying it up; and how much have I spent in that time?

Ans. { 486 days in laying up.
{ 31*l* 7s 9d spent.

97. If I buy 1000 ells flemish linen for 90*l* what may I sell it per ell in London, to gain 10*l* by the whole? Ans. 3s 4d per ell.

98. Bought threescore pieces of holland for three times as many pounds, and sold them again for four times as much; but if they had cost me as much as I sold them for, what should I have sold them for, to gain after the same rate? Ans. 320*l*.

99. There are three quantities of silver, each of the same weight, but different in value; the weight of each quantity is 10 oz. the value of the first sort is 4s per oz. of the second 4s 6d per oz. and of the third 5s per oz. I demand the worth of an oz. when they are all melted down together? Ans. 4s 6d per oz.

100. I have received advice from my factor, that he has disbursed upon my account the sum of 4000 guilders, 15 stivers; I demand what sum I must answer for that in English money, exchange at par; and also what his commission comes to at 2 per cent.

Ans { 400*l* 1s 6d sterling.
8*l* 0s 0d 1qr commission.

101. A merchant bought a parcel of jewels for 220*l* and sold them again for 440*l* payable at the end of 6 months; I demand what the gain was worth in ready money; rebate being made a 6 per cent? Ans. 213*l* 11s 10d +

102. A factor bought 4 chests of sugar, the mark and weight as follows;

	C.	*qr.*	*lb.*
A	10	3	14
B	12	1	17
C	13	1	19
D	11	2	10

Now suppose the tare or weight of every chest, when it is empty, to be 38lb. I demand the neat weight of the said sugar; I also demand the prime cost of the same, supposing it came to 18s per C. including the charges of lighterage, porterage, warehouse-room, custom, &c. also I demand the whole gain; and the gain per cent. supposing the chests A and B were sold afterwards at 28s per cwt. and the other two chests, viz. C and D, at 4d per lb.

		l.	*s.*	*d.*
Ans.	Prime cost	42	4	$8\frac{1}{2}$
	Whole gain	34	16	$4\frac{1}{2}$
	Gain per cent.	82	8	$9\frac{1}{2}$

103. A gentleman a chaise did buy,
A horse and harness too;
They cost the sum of threescore pounds,
Upon my word 'tis true;
The harness came to half of th' horse,
The horse twice of the chaise;
And if you find the price of them
Take them, and go your ways.

Ans.	Chaise	15*l*.
	Horse	30
	Harness	15

104. A gentleman courted a young lady, and as their birth-days happened together, they agreed to make that their wedding-day. On the day of marriage it happened that the gentleman's age was just double to that of the lady's, that is as 2 to 1. After they had lived together 30 years, the gentleman observed, that his lady's age drew nearer to his and that his was only in such proportion to her's as 2 to 1 $\frac{3}{7}$. Thirty years after this the same gentleman found his and his lady's ages to be as near as 2 to

$\frac{3}{4}$; at which time they both died. I demand their several ages at the day of their marriage, and of their death: also the reason why the lady's age, which was continually gaining upon her husband's, should, notwithstanding, be never able to overtake it?

A SHORT COLLECTION OF PLEASANT AND DIVERTING QUESTIONS.

1. A GENERAL having a Castle, situated on a Square, and garrisoned by 48 Soldiers, so ordered them, as that any two Corners, and the Side between them, should consist of 18 Men; but he thinking there were not Men enough, hired 8 more, but still kept up the same Number of 18 Men as before; afterwards 16 Men were paid off, he not having occasion for them; but yet he kept up his Number of 18 Men: I demand how he must place the said Men, to make 18 every way, when he had 48, 56, and 40 Soldiers?

2. A poor Woman carrying some Eggs to Market, met with a rude Fellow, who broke them all; but presently after, considering what he had done, went back and told the Woman he was willing to make satisfaction, provided she could tell how many there were: she answered, she could not tell, but the best Account that she could give, was, that when she told them in by two at a time, there was one left, when by three, there was one left, and when by four there was one left, but when she told them in by five there was none left. I demand how many Eggs the Woman had?

3. A Gentleman's Servant went to Market, with an Order to buy 20 Fowls for 20d. he did so: and brought home Pigeons at 4d apiece, Larks at a Halfpenny a-piece, and Sparrows at a Farthing a-piece: I demand how many there was of each sort?

4. Suppose the 9 Digits to be placed in a quadrangular Form: I demand in what order they must stand, that any three Figures in a right line may make just 15?

5. Let 12 be set down in 4 Figures, and let each Figure be the same.

6. A countryman having a Fox, a Goose, and a Peck of Corn, in his journey came to a River, where it so happened that he could carry but one over at a Time. Now, as no two were to be left together that might destroy each other; so he was at his wits end how to dispose of them; For, says he, though the Corn can't eat the Goose, nor the Goose eat the Fox, Yet the Fox can eat the Goose, and the Goose eat the Corn. The Question is, how he must carry them over that they might not devour one another?

7. Three jealous Husbands with their Wives, being ready to pass by Night over a River, do find at the Water Side a Boat which can carry but two Persons at once, and for want of a Waterman, they are necessitated to row themselves over the river several Times: The Question is, how these 6 persons shall pass by 2 and 2, that none of the three Wives may be found in the company of one or two Men, unless her Husband be present? Wingate.

8. Two merry companions are to have equal shares of 8 Gallons of Wine, which are in a vessel containing exactly 8 Gallons: Now, to divide it equally between them, they have only two other empty Vessels, of which one contains 5 Gallons and the other 3; The Question is, how they shall divide the said Wine between them by the Help of these 3 Vessels so that they may have 4 Gallons a-piece. Wingate

9 Says Jack to his brother Harry, I can place four threes in such a Manner that they shall just make 34; can you do so too?

THE

SCHOOLMASTER'S

ASSISTANT.

PART V.

OF DUODECIMALS.

Q. WHAT are Duodecimals?

A. They are fractions of a foot, or of an inch, or any part of an inch, having 12 for their denominators.

NOTATION OF DUODECIMALS.

Q. How do you write duodecimals?

F. I. '' ''' ''''

A. Thus: 3 7 2 3 7, &c.

Q. How do you read them?

A. Thus; 3 feet, 7 inches, 2 seconds, 3 thirds, 7 fourths, &c.

Note 1. Some call the inches primes, and mark them thus, $'$.

2. Though this manner of dividing and subdividing a foot is endless, yet it is only so in imagination, and cannot be reduced to practice because a second, or the twelfth part of an inch is so small, as to be incapable of any farther division.

ADDITION OF DUODECIMALS.

Note, 12 Fourths make 1 Third.
12 Thirds 1 Second.
12 Seconds 1 Inch.
12 Inches 1 Foot.

EXAMPLES.

No 1					2				
F.	*I.*	*''.*	*'''.*	*''''.*	*F.*	*I.*	*''.*	*'''.*	*''''.*
14	4	3	5	6	28	4	3	7	10
17	10	11	10	4	36	10	3	11	5
16	3	7	5	8	19	10	4	7	6
19	1	10	11	11	39	5	6	9	4
19	3	5	7	11	47	6	2	10	11
46	4	9	10	6	92	11	10	3	7

A joiner having finished several very curious pieces of workmanship, would know the content of the whole; now the first piece measured seventeen feet, ten inches, two seconds, and one third; the second measured twenty feet, four inches, and seven thirds; the third forty-nine feet, six inches and nine seconds; the fourth fourscore feet and ten seconds; the fifth seventeen feet, and four thirds; the sixth threescore feet, and ten seconds; and the seventh thirty-seven feet, and nine thirds; what was the content in square-measure?

SUBTRACTION OF DUODECIMALS.

EXAMPLES.

	No 1					2				
	F.	*I.*	′.	″.	‴.	*F.*	*I.*	″.	‴.	⁗.
From	74	3	4	7	6	100	5	7	3	1
Take	19	4	1	8	10	97	8	9	10	11

A joiner having lined several rooms very curiously with cedar, finds the amount to be, in square-measure 800*f.* 3*i.* 4″. but several deductions being to be made for windows, arches, &c. those deductions amounted to 76*f.* 3*i.* 7′. 10″. 5‴. How many feet of workmanship must he be paid for?

MULTIPLICATION OF DUODECIMALS,

COMMONLY CALLED.

CROSS MULTIPLICATION.

Note, Feet multiplied by feet give feet,
Feet multiplied by inches give inches,
Feet multiplied by seconds give seconds,
Inches multiplied by inches give seconds,
Inches multiplied by seconds give thirds,
Seconds multiplied by seconds give fourths, &c.

Examples.

1. Of Feet and Inches.

No. 1

	F.	*I.*	
Multiply	7	3	
By	4	7	
	29	0	"
	4	2	9
Product	33	2	9

1. Here I multiply the 7*f.* 3*i*, first by 4 feet (which give feet and inches for the product) saying 4 times 3 is 12, set down 0 and carry 1; then 4 times 7 is 28 and 1 is 29, which set down.

2. Next I multiply the same 7*f.* 3*in.* by 7 inches (which give inches and seconds for the product) saying 7 times 3 21, set down 9 seconds, and carry 1 inch; then 7 times 7 is 49 and 1 is 50 inches, or 4 feet, 2 inches which set down; then add them together, and the whole is 33*f* 2*in.* 9 *sec.*

2			3			4			5		
	F.	*I.*		*F.*	*I.*		*F.*	*I.*		*F.*	*I.*
Multiply	7	5		4	6		9	7		8	3
By	3	9		5	8		9	7		6	4
Product	27	9	9	25	6		91	10	1	52	3

6			7			8		
	F.	*I.*		*F.*	*I.*		*F.*	*I.*
Multiply	4	7		3	8		9	7
By	5	10		7	6		3	6
Product	26	8	10	27	6		33	6	6

9			10			11		
	F.	*I.*		*F.*	*I.*		*F.*	*I.*
Multiply	3	11		6	5		7	10
By	9	5		7	6		8	11
Product	36	10	7	48	1	6	69	10	2

The truth of any one of these operations may be proved by reducing the factors into inches, and dividing their product by 144, the number of square inches in a foot square, the quotient will be the answer, viz.

First Sum.

1. *By whole numbers*

F.	I.
7	3 = 87
5	7 = 55

435
435

144)4785(33
432

65
432

33
12

144)396(2
288

108
12

144)1296(9
1296

0

2. *By vulgar fractions.*

F.

Multiply 7 $\frac{9}{12}$

By 4 $\frac{7}{12}$

87 55 4785

— × — = —

12 12 144

Then divide the numerator by the denominator, as before.

3. *By decimals.*

Mult. 4.5833 +

By 7.25

229165
91666
20831

33.228925
12

2.747100
12

8.9652

F. I. "

Facit 33 2 9 nearly.

Note. When the number of feet happens to be large in either or both of the factors instead of multiplying by inches (if any be) you may take parts with them.

EXAMPLE.

No. 1	F.	I.	2	F.	I.	3	F.	I.
Multiply	76	7		46	7		71	7
By	48	9		39	8		84	6
76 × 8 = 608				1847	9	8	6048	9 6
6 × 4 = 304								
48 × 7 = 28		"						
$6\frac{1}{2}$	38	3 6						
$3\frac{1}{2}$	19	1 9						
Product	3733	5 3						

4	F.	I.	5	F.	I.
	76	7		36	1
	19	10		18	8
	1518	10 10		673	6 8

6	F.	I.	7	F.	I.	8	F.	I.
Multiply	84	3		48	7		79	8
By	95	2		26	8		38	11
Product	8017	9 6		1295	6 8		3160	4 4

9	F.	I.	10	F.	I.	11	F.	I.
Multiply	127	6		767	5		7691	10
By	184	8		198	3		1976	11
Product	23545	0		152140	4 3		15206113	6 2

2. Of Feet, Inches, and Seconds.

No. 1	F.	I.	″.	2	F.	I.	″.	3	F.	I.	″.
Multiply	7	3	2		8	6	9		3	10	6
By	1	7	3		7	3	8		7	4	8
	7	3	2		62	6	7	9	28	7	7
	4	2	10 2								
		1	9 9 6								
Product	11	7	9 11 6								

4			5			6		
F.	I.	″.	F.	I.	″.	F.	I.	″.
7	1	9	3	8	4	9	8	7
7	8	9	3	9	2	12	3	10
55	2	9 3 9	13	10	10 4 8	119	8	2 10 10

7			8			9		
F.	I.	″.	F.	I.	″.	F.	I.	″.
9	8	7	3	2	1	5	6	7
6	5	4	2	3	4	8	9	10
62	7	3 9 4	7	2	8 11 4	48	11	2 8 10

Note. If the number of feet is large, instead of multiplying by inches and seconds, you may take parts with them.

Examples.

No. 1

I.	F.	I.	"	
$6\frac{1}{2}$	76	3	9	
	84	7	11	
$76 \times 4 =$	394	0	0	
$76 \times 8 =$	608	0	0	
$8 \times 84 =$	21	0	0	
$9 \times 84 =$	5	3	0	'''
I. $1\frac{1}{6}$)	38	1	10	6
$6\frac{1}{2}$)	6	4	3	9 ''''
$3\frac{1}{4}$)	3	2	1	10 6
$2\frac{1}{3}$)	1	7	0	11 3
	1	0	8	7 6
	6460	7	1	8 3

2

F.	I.	"
71	3	6
92	1	7
6568	2	10 6 6

3

F.	I.	"
56	1	8
97	3	9
5463	0	2 3

4

F.	I.	"
372	2	6
181	1	9
67242	10	6

5

F.	I.	"
87	3	4
18	1	7
1582	6	2 3

6

F.	I.	"
64	3	7
27	2	6
1749	5	5 1 6

7

F.	I.	"
49	3	1
48	1	2
2369	1	5 7 2

8

F.	I.	"
71	2	6
81	1	8
5777	9	2 2

9

F.	I.	"
756	1	8
184	2	6
139287	1	0 2

10

F.	I.	"
487	11	10
186	10	11
912.4	4	2 2 2

A

DECIMAL TABLE

OF

INCHES AND SECONDS.

I. S.	Decim.	I. S.	Decim.	I. S.	Decim.	I. S.	Decim.
1	.006944	1	0.083277	4	1 .173611	3	1.250944
2	.013888	2	.097222	2	2 .180555	2	2.263888
3	.020833	3	.104166	3	3 .1875	3	3.270833
4	.027777	4	.111111	4	4 .194444	4	4.277777
5	.034722	5	.118055	5	5 .201388	5	5.284722
6	.041666	6	.125	6	6 .208333	6	6.291666
7	.048611	7	.131944	7	7 .215277	7	7.298611
8	.055555	8	.138888	8	8 .222222	8	8.305555
9	.0625	9	.145833	9	9 .229166	9	9.3125
10	.069444	10	.152777	10	10 .236111	10	10.319444
11	.076388	11	.159722	11	11 .243055	11	11.326388
1 0	.083333	2 0	.166666	3 0	.25	4 0	.333333

I. S.	Decim.	I. S.	Decim.	I. S.	Decim.	I. S.	Decim.
4 1	1.340277	5 1	1.423611	6 1	1.506944	7 1	1.590277
2	2.347222	2	2.430555	2	2.513888	2	2.597222
3	3.354166	3	3.4375	3	3.520833	3	3.604166
4	4.361111	4	4.444444	4	4.527777	4	4.611111
5	5.368055	5	5.451388	5	5.534722	5	5.618055
6	6.37	6	6.458333	6	6.541666	6	6.624999
7	7.381944	7	7.465277	7	7.548611	7	7.631944
8	8.388888	8	8.472222	8	8.555555	8	8.638888
9	9.395833	9	9.479166	9	9.562500	9	9.645833
10	10.402777	10	10.486111	10	10.569444	10	10.652777
11	11.409722	11	11.493055	11	11.576388	11	11.659722
5 0	5.416666	6 0	6.5	7 0	7.583333	8 0	8.666666

I. S.	Decim.	I. S.	Decim.	I. S.	Decim.	I. S.	Decim.
8 1	1.673611	9 1	1.756944	10 1	1.840277	11 1	1.923611
2	2.680555	2	2.763888	2	2.847222	2	2.930555
3	3.6875	3	3.770833	3	3.854166	3	3.9375
4	4.694444	4	4.777777	4	4.861111	4	4.944444
5	5.701388	5	5.784722	5	5.868055	5	5.951388
6	6.708333	6	6.791666	6	6.874999	6	6.958333
7	7.715277	7	7.798611	7	7.881944	7	7.965277
8	8.722222	8	8.805555	8	8.888888	8	8.972222
9	9.729166	9	9.8125	9	9.895833	9	9.979166
10	10.736111	10	10.819444	10	10.902777	10	10.986111
11	11.743055	11	11.826388	11	11.909722	11	11.993055
9 0	9.75	10 0	10.833333	11 0	10.916666	12 0	1.0

THE CONSTRUCTION OF THE FOREGOING TABLE.

Let it be required to find what part of a foot one second is in Decimals.

1. One Foot reduced into seconds makes 144 seconds.
2. The Vulgar Fraction will then be $\frac{1}{144}$ of a Foot.
3. Divide the upper term by the lower, and the quotient thence arising will be the answer.

```
144)1.000000(.006944+
    864
    ----
    1360
    1296
    ----
     640
     576
    ----
     640
     576
    ----
      64
```

After the same manner the whole table is made, except in the Case of Inches only; as in the case of one inch, where the Vulgar Fraction will be $\frac{1}{12}$ of a foot, Divide the upper term by the lower, as before, and you have the quotient for the answer.

```
12)1.000000(.083333+
   4
```

Note 1. If the given part of a foot consists only of inches the divisor need be no more than 12, because 12 inches make 1 foot.

2. If the given part of a foot consists of seconds only, or inches and seconds together, then 144 must be the divisor; because 144 seconds make 1 foot.

THE USE OF THE FOREGOING TABLE.

Let the first Example in Multiplication be given, viz.

	F.	I.
Multiply	7	3
By	4	7

Look in the Table for 3 inches, against which stands .25 — Again look for 7 inches, against which stands .583333 — Hence it follows, that 7 *f.* 3 *i.* = 7.25*f.* and 4*f.* 7 *i.* = 4.583333*f.*

Note. *It is common in any large number of Decimals, to save trouble in the operation, by making one of them one part larger, which cuts off all the following Figures; thus* 4.583333 *f. may be made* 4.584*f.*

	F.
Multiply	7.25
By	4.584
	2900
	5800
	3625
	2900
	33.23400
	12
	2.808
	12
	9.696

	F.	I.	"
Ans.	33	2	9

Again; let the first Example in Feet, Inches, and Seconds, be given, viz.

	F.	I.	"
Multiply	7	3	2
By	1	7	3

Look in the table for 3 *i.* 2 *s.* and against them you will find .263888; also look in the same Table, for 7 *i.* 3 *s.* and against them you will find .604166; Then, by shortening the Decimals,

Multiply 7.264
By 1.6041

7264
29056
43584
7264

11.6521824
12

7.82516
12

9.91392
12

10.96704
12

11.60448

F. I. " "' "''

Ans. 11 7 9 10 11 the difference being inconsiderable.

DIVISION OF DUODECIMALS.

F.	I.	"	F.	I	"
2)146	7	10	(73	3	11
3)761	4	11	(		
4)963	2	10	(		
5)186	1	10	(		
6) 76	3	11	(		
7)186	1	10	(		
8)712	8	4	(		
9)912	3	5	(		
10)861	11	10	(		

F.	I.	"			
11)123	4	5	(		
12) 76	8	7	"'	"''	
7) 86	3	7	4	8	
8) 98	4	6	9	1	
9) 86	2	1	1	7	
10) 47	3	4	6	1	
11) 96	2	7	11	4	
12) 83	1	6	9	10	
13) 78	10	11	10	9	

Note 1 *It very seldom happens that the Divisor consists of more than one Denomination; yet because such Divisors may sometimes offer themselves, I will give a few for the reader's satisfaction, which must be wrought after the manner of Long Division, and may serve also as proofs to some of the foregoing examples in Multiplication.*

2. *This sort of Division often* admits of two figures at *once in the quotient.*

EXAMPLES.

```
        F. I. F.  I.  "  F. I.
        4  5)33  1  6(7  6
4  5×7 = 30 11
         2  2  6
4  5×6 = 2  2  6
         ------
            0
```

Note. If the feet in the quotient consists of more than one figure, you must consider,

1. How many figures are required in the feet by common Division,

2. If the feet required consist only of two figures, you must multiply the divisor by the first figure, (which stands in tens place) with a cypher annexed. But

3. If the feet required consist of three figures, you must multiply the divisor by the first figure, (which stands in hundreds place) with two cyphers annexed: and the next figure in the quotient (which stands in tens place) with one cypher annexed.

4. Whatever the product is in feet and inches, let it be placed under the dividend, in such manner, that feet and inches may stand under feet and inches, and units under units.

5. With regard to the number of feet in the dividend, you must proceed according to the common method of Long Division, till you have obtained the number of feet required in the quotient.

```
          F.  I.  F.     I.  "  F.  I.
          184 8)235 45   0  0(127 6
184  8 × 100 = 184.66   8
              ---------
               507 8  4
184  8 ×  20 = 369.3  4
              ---------
               1385   0
184  8 ×   7 = 1292   8
              ---------
                92  4  0
184  8 ×   6 inch. = 92  4  0
                    ---------
                             0
```

```
          F.  I.  F     I.  "  F.  I.
          48  9)3733  5   3(76  7
48  9×70  =   3412  6
              ---------
               320 11
48  9× 6  =   290  6
              ---------
                28  5  3
48  9× 7 in. = 28  5  3
              ---------
                         0
```

F. I. F. I. " F. I.
79 8)3100 4 4(58 11

79 8 × 30 = 2390

710 4

79 8 × 8 = 637 4

73 0 4

79 8 × 11 in. = 73 0 4

0

F.	I.	F	I.	"		F.	I.	F.	I.	"
6	7)	31	3	3(		39	8)	1847	9	8(
8	10)	87	7	2(		84	6)	6048	9	6(
8	9)	83	10	3(		19	10)	1518	10	10(
12	9)	130	8	3(		95	2)	8017	9	6(
11	5)	140	9	8(		26	8)	1895	6	8(
9	3)	116	4	9(		18	8)	673	6	8(

F. I. " F. I. " "" "" F. I. "
1 7 3)11 7 9 11 6(7 3 2
11 2 9

5 0 11
4 9 9

3 2 6
3 2 6

0

F.	I.	"	F.	I.	"	""	""	""
7	3	8)62	6	7	9(			
5	10	6)28	7	7	0(			
7	1	9)55	2	9	3	9(		
3	9	2)13	10	10	4	8(		

F.	I	"	F.	I.	"	""	""
12	3	10)119	8	2	10	10	
9	8	7) 62	7	3	9	4	
3	2	1) 7	2	8	11	4	
8	9	10) 48	11	2	8	10	

FINIS.